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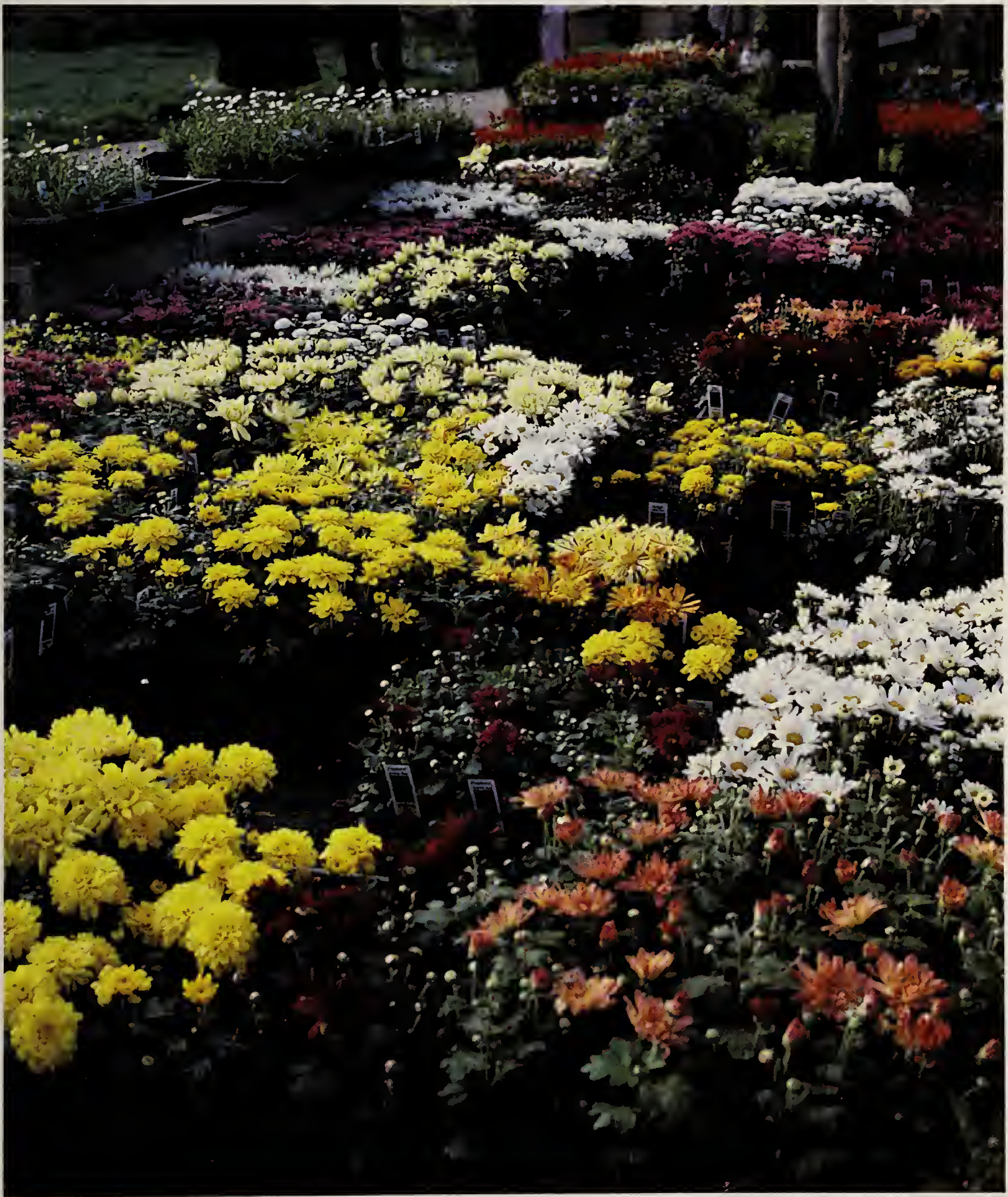
Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens ■ Spring/Summer 1990



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By becoming a member of Denver Botanic Gardens, Inc., you will receive *Mountain, Plain and Garden* and the monthly *Green Thumb News.* You will also have year-round admission to the gardens and unlimited access to the use of the books in the Helen K. Fowler Library, located in Boettcher Memorial Center at 1005 York Street.

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Volume 47 Number 1 Spring/Summer 1990

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Introduction

by Emerson R. Birchfield

"The Flowering of Denver" is the Denver Botanic Gardens' Annual Plant and Used Book Sale on May 10 and 11. The name, of course, implies more, since the purpose of the event is to expand the avenues of horticultural possibilities for regional gardens. Its educational aspect is very important.

This inaugural edition of *Mountain, Plain and Garden* is a flowering, in a sense, as well. This magazine, known since 1944 as *The Green Thumb,* has been updated with a new name, new look, and new format. *Mountain, Plain and Garden* continues *The Green Thumb* and will be published semiannually.

We are pleased that this first issue is a special one for "The Flowering of Denver." It evolves from the so-called "Emerson's Handbook" from the 1989 sale. The handbook was so popular we decided to try our hand at hybridizing: this special edition is the result. It chronicles Rocky Mountain horticulture in the year 1990. The plants offered at the sale, listed within these pages with cultural information, are indicative of the wide variety of plants suitable for our climate and the diverse interests of area gardeners.

It is appropriate, too, that many of the plants are old-fashioned ones. The unique climate of the Denver metropolitan area lends itself to experimentation. While the range of plants grown here has greatly expanded over the years, we look back at dozens of plants that have been perennially popular and have truly made our city bloom. The reason that many of the old-fashioned flowers, shrubs, trees, and vegetables are still available is a testimony to their adaptability and hardy nature. They have become the classics of our gardens.

Although there are changes each year at the plant and book sale, the tables enable us to grasp the enormous scope of plants grown outdoors in Colorado. The lists are not entirely definitive as there are always small quantities of special varieties that are not listed. Each division contains an introduction by an experienced amateur or professional horticulturalist with practical tips and observations. Collectively, among these keen gardeners are literally hundreds of years of experience. Their cumulative experience has made this guidebook possible, although it should be considered only as a guide. Remember that most plants are as adaptable as those who tend them, and they often thrive under less-than-optimum conditions. Gardeners will discover microclimates within their own gardens.

Know what you grow. For accuracy, we list Latin as well as common names. Please don't be intimidated. When consulting expert nurserymen or the books in the Helen Fowler Library at DBG, it is always helpful to know the exact species considered.

With this first issue of *Mountain, Plain and Garden* our focus is on outdoor gardening, although our house plant and bonsai divisions are equally outstanding. We trust "The Flowering of Denver" special edition will serve as a source book not only for the plant sale but as a useful cultural guide for common and unusual plants grown in this area. Please keep this issue for future reference. We plan to update it with supplements every few years.

"The Flowering of Denver" has grown to be a Front Range spring celebration. I approach it with great anticipation, not only for the abundance of exciting plants offered for sale, but for the beautiful results that follow later in the summer in gardens everywhere. Our purchases benefit a very special place—Denver Botanic Gardens.

Denver Botanic Gardens

Pot marigold (*Calendula officinalis*) has been grown in herb gardens since medieval days.

Rob Proctor

Petunia 'Summer Madness' and white *Gomphrena globosa* are effective companions in containers or beds.

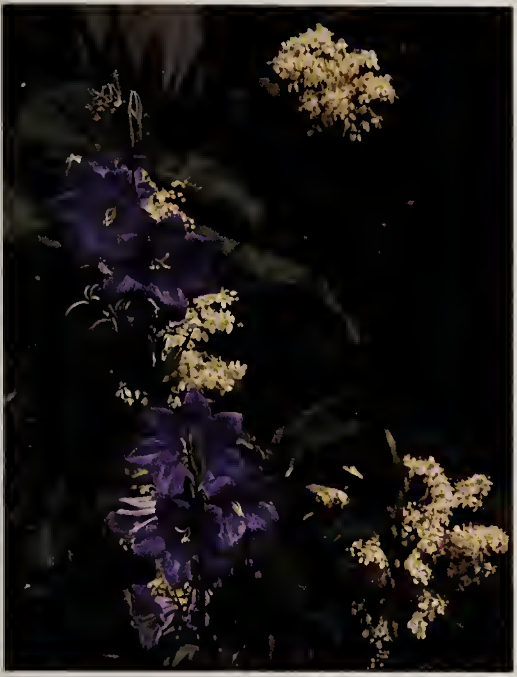
Diane Ibsen

The pretty white flowers of highbush cranberry (*Viburnum trilobum*) are followed by striking autumn fruit.

Denver Botanic Gardens

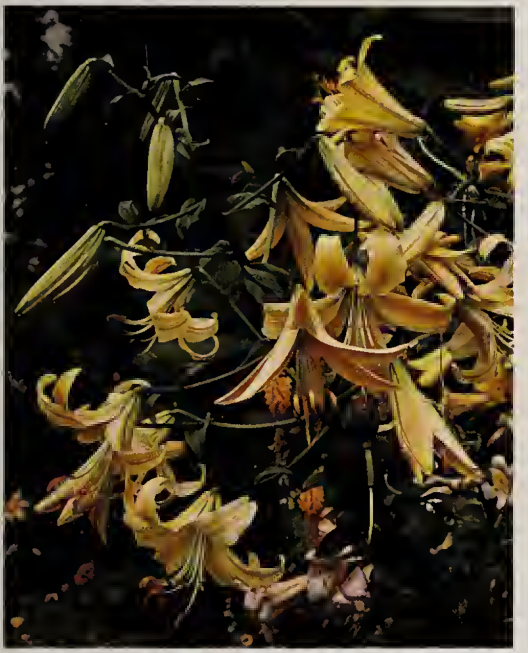
The blossoms of 'Azure Pearls' petunia and 'Irish Eyes' rudbeckia smother the plants in midsummer.

Rod Proctor



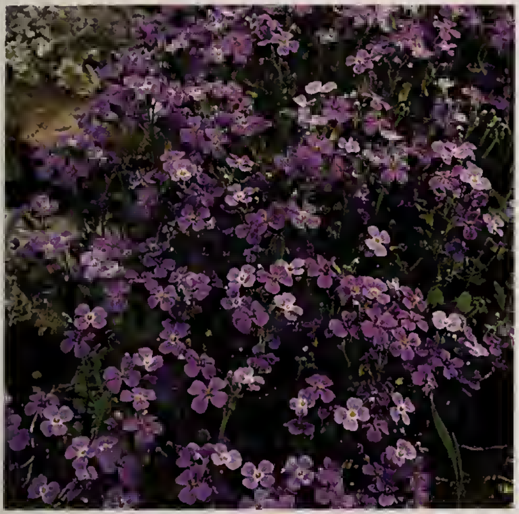
Peach-leaf bellflower (*Campanula persicifolia*) lends old-world charm to a garden.

Rod Proctor



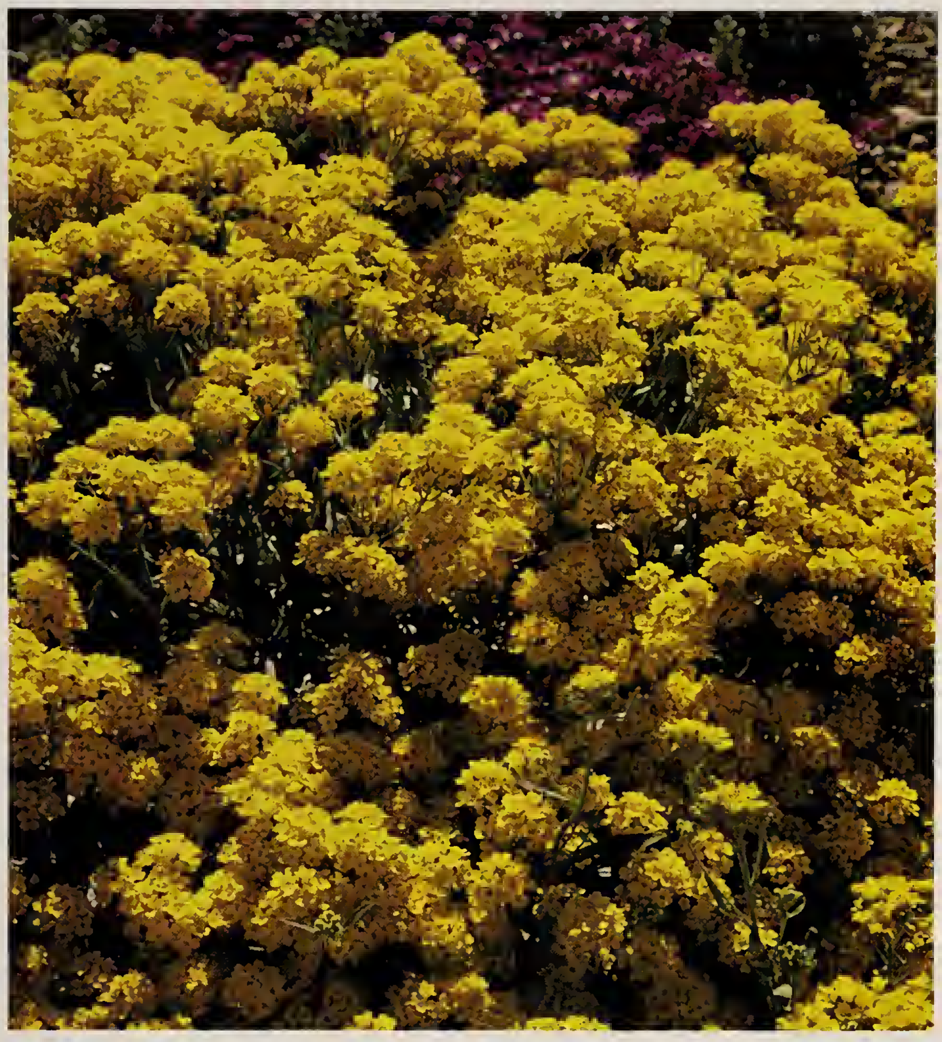
Fragrant and hardy trumpet lilies, sold in the summer bulbs division, grace a garden in July.

B. Whelan



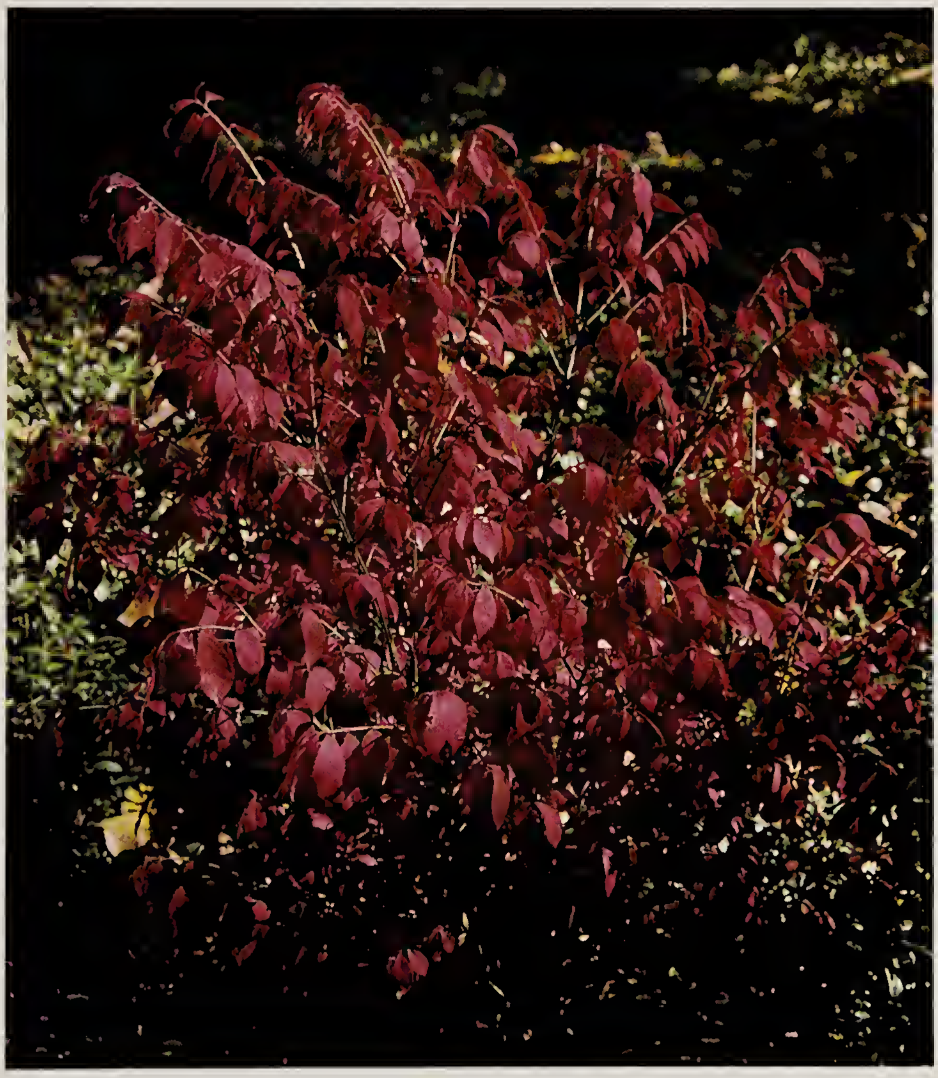
Rock cress (*Aubretia deltoidea*) is a charmer for rock gardens or perennial plantings.

B. Whelan



Basket-of-gold is an indispensable feature of Colorado gardens.

Diane Ibsen



Euonymus alatus 'Compactus' is a dwarf form of the classic burning bush.

Selecting and Growing Annuals

by Joedy Arnold, Co-chairman: with sections by Jeanne Ruggles, Katy Dickson, and Rosemary Laughlin. Sheila Stephens, Co-chairman

It would take a gardener many years to sample every annual that can be grown successfully in Colorado. Either that, or it would require an enormous garden. Those who rely on perennials alone are missing a fascinating class of plants. Various annuals grow from several inches to many feet in height. They are valued for colorful blooms or foliage throughout the growing season.

Annuals did not become an important feature of gardens until the nineteenth century, although nasturtiums, amaranths, poppies, sweet Williams, and hollyhocks were grown several hundred years earlier. During the Victorian era, many new annuals flooded into the western world from tropical lands. The new technology of iron and glass that had made the construction of greenhouses possible, also allowed the seeds of many annuals to be started in early spring and bedded out later. Seed companies hastened the spread of new species throughout the United States. Many of the old favorites are still grown. Heliotrope, flowering tobacco, forget-me-nots, coleus, cosmos, and snapdragons are as important in our gardens as they were in our grandparents'.

The varied shapes and forms, as well as modest expense, make annuals a rewarding choice for the beginner and a source of almost endless variety for the experienced gardener.

Annuals are planted alone or among bulbs to cover unsightly fading foilage; among perennials to unite and provide season-long color; among shrubs to add color and interest. They adapt well to border plantings and containers. Annuals are often grown for cutting, and some are perfect as ground covers.

Three factors determine the adaptability of annuals to your garden: tolerance for sun or shade, preference for a warm or cool growing season, and the length of time plants need to reach maturity from planting to full bloom.

When selecting annuals, remember the importance of planting the right plant at the right time in the right location. Planting tender annuals, such as impatiens, zinnias, coleus, and begonias, should be delayed until late May. Nights below 40°F will stunt their growth. Water requirements vary. Effective irrigation means a good soaking to ten inches. Well-prepared soil not only is essential for good plant growth but also for proper water retention. Generous amounts of organic matter added to create enriched soil for some plants will hold more water than a sandy soil with fast drainage required by other plants. Wind, location of planting, sun or shade, and the soil conditions must all be considered when determining the amount and frequency of water applied. Cultural information is available when purchasing plants, and the tables will prove helpful in planting and care.

In addition to true annuals, some biennials and perennials are also included. Technically, these plants are not annuals. They are used as such because they develop good color in the length of time most annuals do when started from seed. Examples are hollyhocks and foxgloves, which bloom the first year.

In books, seed catalogs, and even at nurseries, annuals are often listed by their common names, which can vary from area to area. Our listing is by the Latin scientific name, followed by the common name. Latin names need not be intimidating—after all, petunia, ageratum, cosmos, begonia, lobelia, salvia, and zinnia are all Latin names. The terms 'cultivar' or 'variety' are now used interchangeably. The term 'cultivar' should be used only for plants that are vegetatively propagated. Since annuals are usually propagated from seed, there is variation in plants although uniformity is remarkable. The term 'variety' is commonly used; for example *Calendula officinalis* variety 'Indian Song.'

After purchasing plants, the next step is the hardening-off process. Find a protected area and place the plants there. Gradually introduce more light each day. After being fully exposed, they should be transplanted into the already prepared beds. The tables suggest the necessary spacing between plants to allow for proper development and avoid potential disease and insect problems brought about by overcrowding. Due to our relatively short growing season, those spacings are reduced somewhat from those recommended by most catalogs and garden books.

Some authorities advise gardeners to grow annuals in poor soil to encourage bloom. Although most flowers don't need the high level of plant nutrients as vegetables, they do require enough to produce healthy vegetation to sustain blooming. Complete fertilizers for garden flowers are readily available. Be sure to read the label carefully, and follow the directions for proper application.

After all the planning and planting, weeding and dead-heading become an on-going process. Dead-heading is simply removing faded flowers to promote more flowering. Sometimes seed heads add interest to the overall effect of the garden and should be left. Poppies and love-in-a-mist *(Nigella damascena)* have attractive seed pods that can be used for dried arrangements.

In addition to favorite annual flowers in our gardens, annual grasses give us the opportunity to relieve this dependency on typical bedding plants and add new interest and dimension to our plantings. Ornamental grasses are not necessarily grown for their foliage, but for their endless variety of flowers and seeds. They add an element of surprise to the garden and can be gathered and dried for winter bouquets as well. As a general rule, they need full sun and average soil conditions.

The Children's Garden division encourages children to explore a fascinating world and develop a life-long friendship with plants. This section is almost a mini-plant sale in itself. Its charm is in the wonderful varieties of plants chosen especially for young gardeners. Gardening is about discovery, and we offer fun and unusual vegetables, and easy flowers for budding horticulturalists.

Children learn how to plant a seedling and how to tend their own gardens. They also learn which plants attract birds and butterflies. There are even gardening projects for rainy days, like making wreaths and working with dried flowers. Stoneware and porcelain cache-pots can be planted by eager young gardeners to make a cherished Mother's Day gift. Many children have a special fascination with flowers and plants—it might be said they go hand-in-hand.

Colorful hanging baskets for the patio suit a variety of sun requirements. We must stress, however, that during the heat of the summer most of the baskets need to be watered every day, sometimes twice daily, expecially if they contain fuchsias. Fertilize the baskets regularly, according to the manufacturer's directions—the reward will be a beautiful show of color all summer long.

Baskets of portulacas, verbenas, nasturtiums, and petunias will thrive in a hot, sunny location.The nasturtiums have been grown without chemicals so they are edible. The lovely California *Euryops* daisy should bloom until the first frost if it is watered regularly. The 'Balcon' ivy geranium is a beautiful lacy plant that is full, lush, and is not susceptible to budworm. It also makes a beautiful ground cover.

Begonias and impatiens can stand morning sun, but prefer shade in the heat of the day. Filtered light under trees is ideal. Ivy geraniums and pansies will also do well with a little shade during the day. Pansies need to stay moist for constant bloom. Fuchsias really sulk in heat, and need full or filtered shade, and their foliage should be misted during the heat of summer.

In Terrace Baskets and Statuary, wicker baskets, wooden or clay planters overflowing with colorful annuals will add a decorative touch to a patio, spa, or windowsill. Many are one-of-a-kind creations and some baskets are planted for shaded areas.

To complement a terrace or garden, consider cast statuary, and terra cotta ornaments and pots. These, and the planted baskets, are displayed throughout the patio and annuals division. Potted plants often look best grouped together rather than space randomly. A splashy note can be made with five or more containers of various sizes clustered together, with combinations of annuals spilling lushly over the sides.

Fruitful Harvest

by Kenneth Roberts, Chairman

Nothing is quite so delightful on a summer evening as wandering through a garden and sampling fragrant, succulent fruits and berries. Contrary to what may people think, a spacious yard is not necessary to have a mini-orchard. A small garden can include a surprising variety of these productive trees, vines and shrubs in a traditional landscape. Dwarf and semi-dwarf trees can be used to define property lines, and raspberries can fill in that empty corner in the back yard. Mix colorful 'Red Lake' currants or one of the many varieties of dessert gooseberries in with spring flowering shrubs, or blueberries with the evergreens—if the soil is on the acidic side. Strawberries make a wonderful ground cover and an apple, pear or plum tree can be espaliered behind a garage or along a fence. And, what garden doesn't have room for an arbor filled with delicious grapes?

Plant fruits, vines and berries where they get the maximum sun. There are some varieties which will tolerate some shade but, in general, the more sun the better. Prepare the soil well. Dig an ample hole; the rule of thumb is twice the width and depth of the root ball. Enrich the soil with about 1/3 peat moss. The peat moss is particularly important in the Denver area because of our alkaline soil. Most fruits prefer a slightly acidic soil with a pH between 5.5 and 6.5, and peat moss is a wonderful natural acidifier. Ensure that the soil is well drained. Do not plant fruit in low areas which have a tendency to collect water.

Plant a standard fruit tree with the graft just below the soil level. Do not bury the graft of a dwarf fruit tree as roots may generate above the graft and the tree will grow to full size. Fill the hole carefully with the soil/peat moss mixture being careful to avoid air pockets. It is helpful to fill the hole about halfway, fill the hole with water and then finish filling. Build a slight rim around the hole to hold water, and mulch to help retain moisture.

Give the tree or bush an initial pruning. The trees offered at the plant sale have been pruned properly. However, branches broken in handling should be cut back. Also, trim off unwanted branches to improve the shape. Sweet and sour cherries can be pruned harder to stimulate faster growth.

Fruit trees require ample moisture but will not tolerate standing in water. Periodically soak the soil well to the depth of the roots. Feed two to three times from the early spring through early summer with a 5-10-5 fertilzer, and control insects by spraying every week to two weeks from petal drop to harvest.

Once established many fruit trees become too productive to produce quality fruit. Limbs may actually break under the load of small, gnarled, unattractive apples, peaches or pears. Don't be afraid to thin out the surplus. Some years it may be required to thin more than half of the developing fruit. It takes courage but the reward will be an abundance of large well-formed produce.

The table lists fruiting perennials, shrubs, trees and vines for Colorado gardens.

Ancient Herbs in the Modern Garden

by Diane Ipsen

A perusal of the history of gardens and garden design reveals that the cultivation of herbs is indeed an ancient practice. Schools of herbal medicine, apothecaries, monasteries and temples, universities and botanical gardens in both the New and Old Worlds record gardens of herbs, some dating back centuries. Herbs graced the cottage dooryard and kitchen gardens of the early American settlers because such plants were indispensable to the smooth maintenance of any household.

The herbs of yesteryear still captivate today's gardener. The current enthusiasm for cultivating herbs perhaps derives as much from the fascinating herbal lore and the magical significance these plants had in people's lives as from their current uses. For example, curious legends embellish the past of *Rosmarinus officinalis* about which Shakespeare wrote, "There's Rosemary, that's for Remembrance." Greek scholars wore garlands of the herb to stimulate their minds and assist memory; rosemary wine was a remedial tonic of great renown. Today's herb gardener uses sprigs of rosemary in the cooking of meats—or may bring the entire plant indoors to decorate as a small evergreen tree at Christmas. Similarly, Lady's mantle *(Alchemilla mollis)* was the medieval alchemist's herb, for the diamond-like dew which collects on the leaves was thought to have magical properties. Lady's mantle is grown today for its exquisite foliage and chartreuse flowers that make a lovely border or planting above a stone retaining wall.

In fact, herbs are rarely grown for their flowers alone, though their textural variety and foliage coloration can lend exquisite beauty to a well-designed bed. Rather than contributing a mere seasonal splash, herbs give pleasure throughout the year with fragrance, flavor and cosmetic uses. A range of homemade products such as potpourri, lavendar sachets, herbal vinegars or jars of dried herbs are perfect for gift-giving.

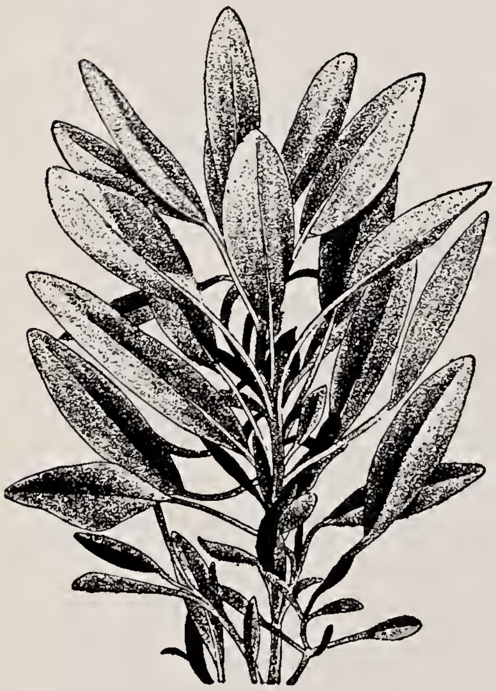
The gardener considering herbs may imagine a formal 'knot garden' or other intricately laid-out patterns with clipped borders and symmetrical paths. Such a well-ordered garden dedicated to herbs gives pleasure with its form and arrangement, but many herbs can be effectively mixed with less formal, more natural plantings to add a new visual quality to the garden. Simple, old-fashioned flowers look best with herbs, rather than those bred for extravagant blooms. Massed as ground covers, sweeping over steps or softening a wall, herbs can assume a more contemporary role in home landscaping.

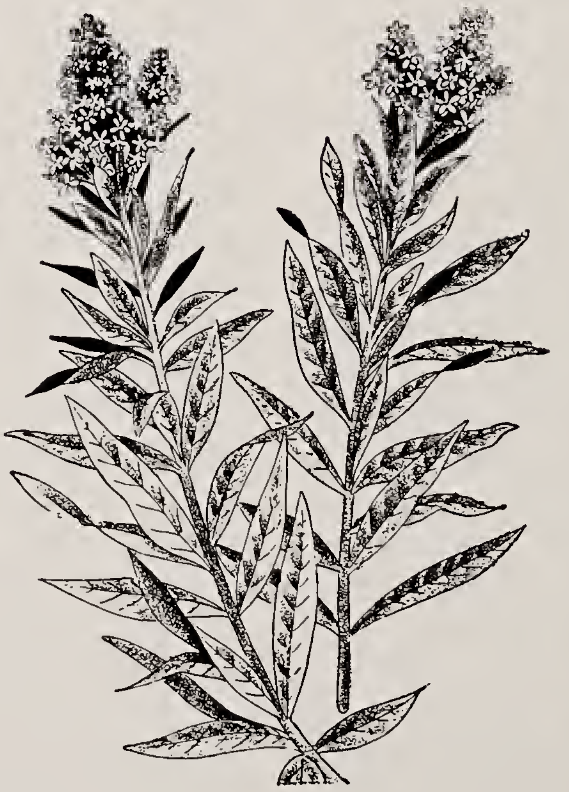
As a group, herbs are generally thought of as plants with uses and their great functional versatility in the garden is certainly one way to employ them. Hyssop *(Hyssopus officinalis)* is an old medicinal herb, but serves as a fine edging plant that can be clipped like boxwood. It blooms from July until frost. Fuzzy lamb's ears *(Stachys byzantina)* is an effective ground cover and a lovely silver-gray foil for hot colors or lush greens in the garden. Sweet woodruff (*Galium odoratum)*, the flavoring of the German May wine, is one of the most charming ground covers for shady spots, delighting with it mass of dainty white flowers shortly after May Day. Perilla *(Perilla frutescens* 'Crispa'*)* lends a rich burgundy to the cutting garden and is handsome and long-lasting incorporated in flower bouquets. The many varieties of thyme may carpet the ground around other plantings or soften steppingstones, but how nice to pluck for the soup pot as well (or enjoy the fragrance if it is trod upon). Numerous herbs like the artemesias provide striking accent in the rock garden.

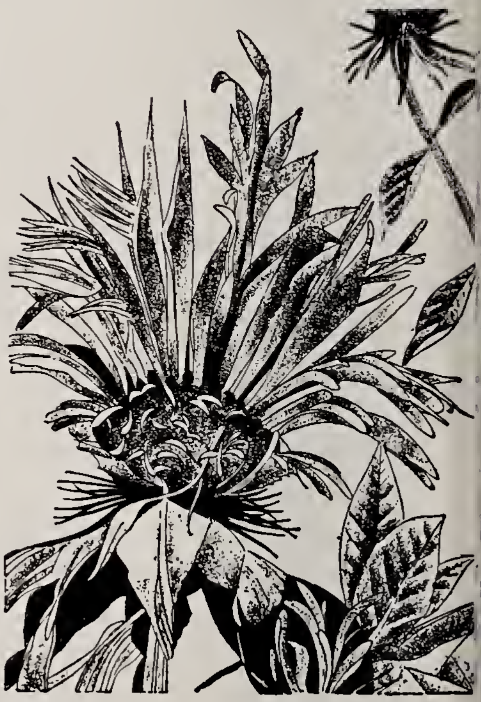
Colonial Americans were well-versed in practical herbal applications. The pungent leaves of tansy *(Tanacetum vulgare)* were often strewn on floors or along foundations as a deterrant to ants, or leaves of costmary *(Chrysanthemum balsamita)* were pressed in drawers to repel moths. Teas and infusions treated a variety of ailments, and it can be fun to revive the custom of chamomile, spearmint or applemint steeped fresh from the garden to comfort and soothe. Even to the unadventurous, simply using fresh herbs in cooking is perhaps the most delightful reason for growing them. A cluster of chives to snip for cottage cheese, a mass of fragrant basil for fresh pesto, parsley for the antipasto, and a border of chervil for garden tomatoes are essential to *al fresco* feasts. Dill, mint, and marjoram will have a thousand uses upon your table and be remembered long after the snows fall. With fresh herbs at one's fingertips, our gardens are not just pretty palettes of display, but, being integrated into our patterns of living, become a means of connecting our daily lives to the tradition of the past.

Happily, herbs are easy to grow and do not require soils or complex horticultural skills. Moreover, they seem especially well-suited to our continental climate along the Front Range. Many herbs are indigenous to the Mediterranean area and thrive in our dry sunny region, provided they are kept out of heavy clay soil. Gardening in a half-shaded situation can include any of the mints, chervil, lovage, sweet woodruff, parsley, angelica, bergamot, pennyroyal, or even tarragon if the soil is not too moist. The table provides cultural instructions.

After the first frost, enjoy the pleasure of fresh herbs growing on a kitchen windowsill. Try pots of lemon verbena, parsley, marjoram, Greek oregano, chives, rosemary, lemongrass and basil for a winter herb garden. This should keep the gardener supplied until the garden is again lush with flavors and fragrances.







"Here's your sweet lavender, sixteen sprigs a penny,
Which you'll find my ladies, will smell as sweet as any"
—street cry of nineteenth century London lavender sellers

Colorado Style: A Perennial Perspective

by Rob Proctor
John Reber, Chairman

Gardening in Colorado presents unique challenges as well as tremendous opportunities. Our abundant sunshine, dry winters, and low humidity save us from so much grief about disease and pests. On the other hand, we must cope with drying winds, high summer heat, and unpredictable frosts and storms. Local gardeners are a resourceful lot, and have found that this climate allows us to grow many traditional perennials, as well as an exciting range of native plants.

Garden design is a matter of personal taste, and there are many schools of thought about the best approach for our area. Most of them have merit, and design must take many variables into account. Shaded gardens of the inner city have a distinct character, as do foothill gardens and those on the plains. Considering the site and choosing adaptable perennials ensure success.

The perennial border is considered the ideal by many, but there are many other options. Naturalistic gardens, formal gardens, and interpretations of cottage gardens can all be successful. Low-water plantings can be as lovely and colorful as traditional ones. Native plants and ornamental grasses contribute to a uniquely-Colorado style with an exciting interplay of form and texture. Using plants from around the world from similar climates further increases the palette of the garden artist. Perennial plantings are enhanced by a well-chosen selection of shrubs, bulbs, herbs, annuals, and even vegetables. The true Colorado style incorporates many influences and evolves to new glories each year.

Gardens in partly-shaded areas rely on many old-fashioned flowers that have been grown for generations, and they are especially appropriate for plantings around Victorian homes. Jacob's ladder *(Polemonium caeruleum)*, Allegheny foam flower *(Tiarella wherryi)*, globeflower *(Trollius ledebouri)*, and bleeding heart are often found in vintage gardens. The dark, heart-shaped leaves of *Ligularia dentata* are effective accents. Ivory spires *(Cimicifuga racemosa)*, meadow rue *(Thalictrum* sp.*)*, and monkshood *(Aconitum napellus)* add height and grace. The many varieties of hosta have lovely leaves and underrated fragrant flowers, as do the hybrids of leatherleaf *(Bergenia cordifolia)*.

Sunnier gardens often feature phlox, bellflowers, peonies, daylilies, columbines, and cranesbills. These favorites from the cottage and dooryard gardens of the past still deserve a valued place in contemporary designs. Heirloom flowers may even be incorporated in dryland plantings. Indian blanket *(Gaillardia aristata)*, purple coneflowers *(Echinacea purpurea)* and *(E. pallida)*, blue flax, lamb's ears, and iris were favorites a century ago and are even more popular today because of their hardiness and ease of culture. They associate beautifully with the grasses, penstemons, and sages of our rich native flora.

Perhaps the one weakness of our Colorado style is the result of our own enthusiasm each spring. We tend to shop and plant early, concentrating on blossoms of spring and summer. Gardens too often peak early and lack interest in autumn and winter. *Anemone X hybrida* 'Honorine Jobert' and 'Prinz Heinrich' bloom at the first hint of the coming fall. Asters and chrysanthemums provide a wide spectrum of colors late in the season. Flowers such as *Coreopsis* 'Moonbeam' and 'Baby Sun,' and Maltese cross bloom over a long period. Blackberry lily *(Belamcanda chinensis)* blooms in summer and displays shiny "blackberries" later. Silver lace vine, if given room enough to ramble, cloaks a fence with white frosting late in the season, Others, such as umbrella plant *(Peltiphyllum peltatum)*, plume poppy *(Macleaya cordata)*, and soldiers and sailors *(Pulmonaria saccarata)* have handsome leaves that add a special impact even when the plants are not in bloom.

Plant Donations: Sharing the Best

by Marilyn Moore, Co-chairman
Elinor Newmarker, Co-chairman

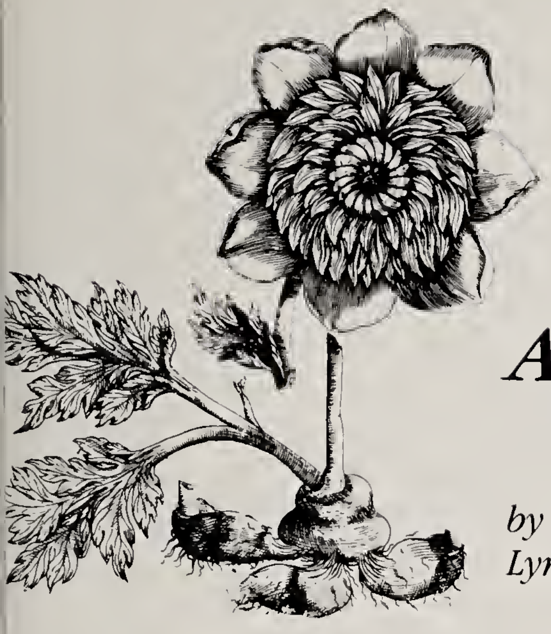
The Plant Donations division features an especially varied and exciting selection of herbaceous perennials and ground covers, as well as a limited number of fruits, vegetables, herbs, trees, and shrubs.

As areas of the Denver Botanic Gardens are redesigned and replanted, many choice plants that aren't included in new designs are divided and potted up for sale in Plant Donations. Gardeners looking for unusual or rare plants will be delighted to find poppy mallow *(Callirhoe involucrata), Dianthus turkestanicus,* giant sea holly *(Eryngium giganteum)*, and *Ligularia dentata* as well as many other outstanding flowers from the perennial border. The many varieties of chrysanthemums growing at DBG have been carefully evaluated, and the very best of these are divided for gardeners seeking dependable fall color for a sunny spot in their gardens.

Ground covers on sale in quantity this year will include the beautiful blue Turkish veronica *(Veronica liwanensis)* and border jewel *(Polygonum affine)*, which is so frequently recommended for low water use plantings. Many other drought-tolerant plants suitable for dryland gardens (or just a dry corner of the garden) are available, including rabbitbrush and *Euonymus fortunei* 'Coloratus,' as well as several varieties of ornamental grasses.

In addition to plants from DGB, this division offers a wonderful selection of plants donated by some of metropolitan Denver's finest gardeners. All these plants are proven to grow, thrive, and multiply in regional gardens — and because they are homegrown, prices in the Plant Donations division are extremely reasonable. There is no table of information for this division, because it is impossible to reliably predict what gardeners will share. Check the perennial table, in particular, for cultural requirements.

Please be aware that because many of these plants have been recently dug and divided, they may require a little extra attention to watering and some protection from wind and sun until their roots are reestablished.



Alpines for Colorado

by Panayoti Kelaidis
Lynda Goldstein and Kathy Borgen, Chairmen

As cities grow, and gardens shrink, the value of small plants correspondingly increases. Small plants permit variety in small places, thereby creating a longer season of bloom and interest, but groundcovers and small perennials provide a greater sense of scale and spaciousness in intimate settings. Alpines are nature's quintessential miniatures: dwarfed by climate and heredity, over the last century an immense assortment of wild flowers from the world's high places have been tamed and brought into horticulture. Garden alpines may look very much like their wild brethren, only they often germinate more quickly and mature much faster, growing in gardens with much greater ease.

The first European alpines appear to have been cultivated in the late Rennaissance by the first enthusiastic collectors of ornamental plants such as Parkinson and Gerard in England. Often associated with herbalism and utilitarian plants, both great English garden writers grew a variety of high mountain plants from the Alps which have always been primarily of asethetic import. The bear's ear primrose of gardens is often called auricula, although that wild primrose *(Primula auricula)* is invariably yellow in color, and garden hybrids represent centuries of selections among a handful of species in this section. Few primroses can compare with the auriculas for tenacity, delicate bloom and subtle fragrance. Auriculas are ideally suited to growing in shady rock gardens in the Denver area and surrounding mountains, needing only shade, gritty soil, cool roots and water during prolonged droughts.

Most beginning gardeners associate rock gardens with sedums and sempervivums, and many a wag has pointed out that most gardeners begin and end their horticultural careers among these accommodating succulents. Hundreds of hybrids have been produced among the houseleeks, some of which have dazzling red or yellow-green rosettes, but none will exceed the grace and beauty of the common spiderweb houseleek *(Sempervivum arachnoideum)*. Each rosette has a dense webbing of hairs twined from leaf tip to leaf tip to exactly resemble a miniature spiderweb. This astonishing feat should be enough for any self-respecting plant, but this one goes on to produce a cluster of showy, six-petaled flowers of dusky rose. A pure white form has been introduced recently.

Most gardeners have the misfortune of starting their sedum careers with *S. album* or *S. sexangulare,* two delightful and utterly demoralizing weeds, since even the tiniest rootlet or fallen leaf quickly form a veritable horde of progeny. There are several notable sections to this genus which consist of tap-rooted clumpformers that barely spread at all without human interference. The best of these for rock gardens is *Sedum sieboldii,* a very showy trailing ground cover with highly succulent blue leaves and glowing pink flowers in late summer.

Perhaps the most famous triplets among rock garden plants are three indestructible plants in the mustard family: *Aubrieta deltoidea, Iberis sempervirens* and *Aurinia saxatile (syn. Alyssum saxatile).* All three are sold universally by garden centers in the state, and planted by the acre every year. Aubrieta usually has deep purple flowers that smother the plant as effectively as snow for much of April and May. It seems to do best on a shady bank in Colorado, although it will withstand full sun with reliable soil preparation and mulching.

Basket-of-gold is one of those perennials that will persist indefinitely in local gardens no matter what sort of treatment it is given. The coarse, bristly gray rosettes are evergreen and are completely obscured during April and May with innumerable little yellow stars. It should have a place in every Colorado garden.

Rock cress *(Arabis caucasica)* is not planted nearly as often as it deserves. Originally from the Caucasus of the Soviet Union, this sturdy perennial seems to thrive in almost any soil, exposure or watering regime it is subjected to in Colorado. The mounds of neat, dark gray-green rosettes are decorative at all times of the year, and the froth of white or pink blossoms in spring is always welcome.

These old-fashioned rock garden plants need not be planted only in rock gardens. They can be used as edgings or even in mass plantings as ground cover. They have proved their mettle over the years in gardens around the world.

The Versatile Rose

by Betty Lou Roberts, Chairman

Throughout history no flower has been more cherished, revered, or steeped in tradition as the rose. In the landscape this timeless favorite offers permanance, and rewards the gardener year after year with fresh, fragrant blooms. Roses can be used as a foundation planting, as a border, in pots on a patio, climbing a trellis or fence, and, of course, in a rose bed. Roses are a traditional symbol of love and repay the gardener's devotion with their beauty.

Every garden has room for at least one rose. In a shrub border, try mixing old-fashioned roses with spring-blooming plants like forsythia and lilac to extend the spring color well into summer. Perennials and roses are a classic combination. Roses provide a constant display while various perennials have peaks of bloom. Climbers and ramblers are excellent camouflage for unsightly buildings, fences and walls. Rose-covered arbors evoke a nostalgic feeling. Some roses sprawl over the ground and act as a colorful ground cover. Roses grown in containers are popular for small city gardens and balconies. A rose hedge will add elegence to a garden: use one basic color and size, and plant closely to ensure dense growth.

HYBRID TEA: The "tea rose" we know originated in France in 1867 and is constantly being improved. Elegant, high-centered blooms on long stems are often fragrant. Plants are grafted onto vigorous shrub rootstock and bloom continuously.

POLYANTHA: These also originated in France about the same time as hybrid teas. They are derived mainly from *Rosa multiflora,* crossed with tea and China roses. Low-growing, continuous-blooming plants produce large clusters of small flowers.

FLORIBUNDA: This is a cross between the classic hybrid tea and the polyantha. Blooms resemble hybrid tea in form and color but are borne in clusters. Most plants are disease-resistant, hardy and low-growing.

GRANDIFLORA: These varieties came into being about 25 years ago as an American classification to designate roses that are intermediate in habit between hybrid teas and floribundas. From the hybrid tea, grandifloras inherit flower form and long cutting stems. From the floribunda, they receive hardiness and continuous clusters of blooms. Plants are generally taller than hybrid teas.

MINIATURE: This type of rose is a tiny reproduc-

tion of a full size rose, with flowers, leaves and stems in proportionate size. Plants range from 3 to 4 inches high to 18 to 24 inches tall. Most bloom continously but few have fragrance.

CLIMBERS and RAMBLERS: This category contains tall-growing (6 to 20 feet) plants of any one of the other rose types but none are true climbers since they have no tendrils and must be tied to a support. They may be everblooming or bloom in one wild flush in the spring.

OLD GARDEN ROSES: These are any roses existing before 1867. These roses stand on their own virtues: hardiness, fragrance, and low maintenance. Few plants are as tough and tolerant of neglect and poor growing conditions as shrub roses. They vary in height from low-growing ground covers to taller types used in hedges.

The variety selected will depend on its use. For a container, look for a compact and floriferous variety, and remember that it will need special protection in winter. A miniature or a polyantha will best suit a small container while a large container will accomodate one floribunda. Miniature roses are perfect for low edgings, and shrub roses work well for a large screen. Climbers are suitable for arbors, trellises, fences and walls. Flower-arranging enthusiasts should consider planting fragrant hybrid teas or gradifloras.

Roses need a minimum of six hours of sun a day. Morning sun is essential, and partial afternoon shade is acceptable, but full sun is ideal. Plant roses at least 15 feet away from the spread of large trees. Miniatures and climbers will be happy with a little less sun. Soil preparation is critical: soil should be light and rich. Improve it with organic matter such as peat moss, leaf mold or compost.

You can't give a rose too much water, but a rose will not tolerate wet feet. Normally a rose should receive the equivalent of one inch of rainfall per week starting in early spring and continuing through fall. Hot and dry weather may call for watering every three or four days. Soak the soil to a depth of eight or ten inches each watering.

Roses are heavy feeders, so regular applications of fertilizer are required for optimum bloom. Begin to fertilize newly planted bushes after the plants become established, about three or four weeks after planting. The rate, frequency and kind of fertilizer depend on the type of soil. Roses should be fed at least three times a year with a rose fertilizer spread over the root area. Do not fertilize after August, or soft, weak growth will invite winter kill. Insect and disease prevention begins when leaves begin to emerge in early spring. Spray or dust with a multi-purpose rose spray once a week or so until cold weather. In Colorado most roses need winter protection; shrub, old garden, and miniatures are relatively hardy and need little protection. The best protection is to mound soil over the canes to a height of at least 12 inches. This is then removed when growth starts in spring.

Bulbs for Summer Color

by Janet Sickafuse, Chairman

Bulbs were a very important part of gardens of the past, and they remain as favorites today. Whether a garden has a nostalgic look or totally modern outlook (the differences are not always clear) bulbous plants may provide important focal points. Many of these flowers are used for arrangements, and may be grown in a mixed planting of annuals and perennials, or in a separate cutting garden.

Among the most stately of bulbs are the elegant and often very fragrant lilies. Asiatic hybrids are the shortest of the lilies, the easiest to grow, and the earliest to bloom. Their vivid rainbow hues are effective in the garden for cutting. Trumpet, or Aurelian, hybrids are taller and save their impressive flowers until mid-summer. Stems can grow to five feet or more, and the sweet fragrance pervades the evening air. Oriental hybrids, including the Rubrums, bloom in late summer or early fall, and rival orchids in beauty; they also carry a delightful scent. Hybrids of the old-fashioned tiger lily, *Lilium tigrinum,* range in color from the familiar orange with black spots to pink, lemon, buff and cream. Their down-facing flowers with recurved petals have made them favorites for generations. They are very hardy and can be planted in their own groupings or in a mixed bed. Lilies can be left in the ground all year, topped with mulch, and they will continue to bloom and increase. They may also be planted in the fall. They will rarely attain their full height the first year.

Winter-hardy gladiolus and liatris are also perennial in Colorado. The gladiolus are smaller than most of the garden hybrids, but have a charming appeal. Liatris are the most drought-tolerant of bulbs, and the feathery spikes are pretty in sunny beds.

Dahlias and cannas are impressive accents in any planting. The brightly-colored dahlias grow as tall as five feet and are excellent for arranging if the stems are seared with a match and quickly plunged into cold water immediately after cutting. Cannas carry bold foilage topped with clusters of exotic flowers. The leaves provide an unexpected tropical effect in a planting. They often look best planted at the back of a bed in clumps of three or five, and are complemented by flowers of a finer texture in front, such as yarrow, coreopsis, cosmos, or rudbeckias.

Abyssian gladiolus *(Acidanthera bicolor* 'Murielae'*)* have beautiful, sweet-scented, white flowers with maroon markings at the base of the petals. Old-fashioned montbretias have a similar look, and the gold and orange flowers are great for cutting. Their leaves resemble those of iris. Tuberoses, shell flowers *(Tigridia pavonia)*, and stars of Bethlehem *(Ornithagalum)* all make exciting additions to flower beds and bouquets.

The garden gladiolas, dahlias, cannas, Abyssinian gladiolas, tuberose, tigridias, and stars of Bethlehem need to be dug in autumn, dried, and stored in a cool, dry place until replanting in spring. Montbretias can be treated in this manner, although they often prove to be hardy in sheltered gardens.

Full sun to partial shade is appropriate for all of these, with slight variations. All benefit from planting in well-drained soil supplemented with humus. Oriental lilies need a more acidic soil, so the soil should be liberally amended with peat moss. Watering for summer bulbs is average — slightly less than a typical lawn — except for cannas, which prefer more water. All summer bulbs benefit from a mulch to keep the roots cool and help retain moisture. Shallow-rooted ground covers or annuals provide the same protection. Because most summer bulbs are more effective planted in groups of three or more, suggested groupings for each variety are indicated in the table.

Classic Trees and Shrubs

by Diane Ipsen with Alan Rollinger
Eva Littlefield, Chairman

Before designing and planting your flower gardens, it is wise to create "the garden" in the larger sense. One dated concept is the linear and boring foundation planting — the "parsley garnishing the turkey" that has restricted residential design. For an aesthetically-pleasing outdoor living area, spaces should be created, and the overall structure planned intelligently. In order to create the skeletal structure of the garden, establish a backdrop for more detailed plantings, to screen and to give privacy, and to create a feeling of enclosure. A well-chosen variety of shrubs and trees will evoke the sense that the space around a home is a special place.

Shrubs and trees, while giving structure to a garden, have color, texture, and fragrance as specimens in their own right. The seasonal dynamism that the woody plants will add — flower, foliage, fruit, and winter form — may be the most important landscaping aspect to consider. Additionally, shrubs can attract butterflies and birds, or contribute to an edible landscape.

We all love the old familiar favorites. Imagine blazing mounds of golden forsythia, snowy spireas, the crimson glory of a highbush cranberry in autumn or the red stems of dogwood against a new-fallen snow. But if you are weary of incessant pruning of shrubs over-scaled for your garden and disappointed by frozen flower buds — take heart. Many improved selections of these heirloom shrubs are now available in compact forms or show much-improved hardiness for our late freezes. They are bred for the smaller urban yard, for ease of maintenance, and for overall beauty.

Forsythia x intermidia 'Northern Sun' is an improved variety which blooms reliably. New selections of our native redosier dogwood *(Cornus sericea)* display specific traits: 'Baileyi' produces superior red stems (always enhanced by proper renewal pruning) and 'Isanti' is more compact than the sizeable species, with maximum height at 6 feet. Don't forget the 24 inch dwarf 'Kelsey' dogwood, whose stems get redder in the winter. Some of the more delicate stems die back, so prune this one to the ground in spring. Quince *(Chaenomeles japonica)* is a monstrous shrub but the many dwarf forms, 'Texas Scarlet' or 'Jet Trails' for example, can provide that appreciated April bloom where a 4 foot shrub is more suitable.

Anyone who has grown 'Vanhouttei' spireas knows what space-dominating plants they are. Inevitably, this graceful shrub suffers hacking and chopping by the homeowner trying to make a smaller shrub of it, thereby destroying its form as well as next year's flower buds. Similar form and flower can be obtained by using the smaller three-lobe spirea *(Spiraea trilobata)* or the more exploding 'Snowmound' *(S. nipponica)*. The pink summer-blooming spireas, like the old-fashioned favorite *S. bumalda* 'Anthony Waterer,' are only 2-1/2 feet tall. Even smaller are the many wonderful dwarf varieties like *S. bumalda* 'Limemound,' *S. japonica* 'Little Princess,' and *S.* x 'Goldmound'.

The compact form of burning bush *(Euonymus alatus* 'Compactus'*)* has been with us since 1926 and offers that marvelous autumn red and interesting bark in a 5 foot rather than 15 foot shrub. A dwarf version of the big familiar ninebark is *Physocarpus opulifolius* 'nana,' a 4 to 5 foot shrub with arching branches which produce masses of pinkish-white flowers in June. Butterfly bush *(Buddleia alternifolia)* is another heirloom shrub often seen in Denver parks, for it is a big 20 foot specimen. The smaller butterfly bush, *B. davidii,* is available in countless hybrids for a late summer display. Ever wonder what that large hibiscus-like flower is that blooms around town in September? Rose of Sharon *(Hibiscus syriacus)* is an old-time shrub that can be counted on for blue, white or pink flowers when little else is showy.

Michael Dirr writes that "a garden without a viburnum is akin to life without art or music." For small gardens, the highbush cranberry *(Viburnum trilobatum* 'Compactum'*)* is a neat 4 feet. Wayfaring tree *(V. lantana)*, which is insect- and disease-free, is actually a large shrub. It withstands shade and is excellent for screening. Early-blooming *Viburnum* x 'Juddii' is intensely fragrant and its coarse light green leaves contrast well with more finely-textured plants. All have remarkable red fall color.

For a hedge that needs a minimum of maintenance, consider using alpine currant *(Ribes alpinum)* a tidy 3 to 4 foot shrub which has been grown for generations in our area. It doesn't need shearing. Tired of trying to keep a hedge of common privet, which grows to 12 feet, at a 3 foot height? For that old-fashioned tailored look, *Ligustrum vulgare* 'Lodense' is a new and excellent substitute that has a more sensible height of 3 feet. It is semi-evergreen and tolerates heavy shade.

Finally, we should not overlook the most tried and true heirloom shrubs we have: the natives. The early settlers dug specimens out of the mountains and creek beds for their fledgling gardens, bringing back potentillas, currants, wild rose and cherry. 'Abbotswood,' and improved selection of potentilla, sports larger white flowers which combine well with the more familiar yellow forms. While potentilla is not very drought-tolerant, many natives are, such as rabbitbush *(Chrysothamnus nauseosus)*—available in dwarf form, gambel oak *(Quercus gambeli),* fernbush *(Chamaebatiaria millefolium)*, and cliffrose *(Cowania mexicana)*. Non-natives with drought tolerances include lavender-flowered Russian sage *(Perovskia atriplicifolia)* and dwarf fragrant sumac *(Rhus aromatica* 'Gro-Low'*)*, an excellent 2-1/2 foot shrub for dryland plantings.

Trees, too, can be drought tolerant. Everyone is familiar with the long-beaned catalpa *(Catalpa speciosa)* that perfumes the air in June with its blossoms. Less well-known may be the Kentucky coffee tree *(Gymnocladus dioicus)*, though it has been planted in Denver for almost one hundred years. Consider both of these trees, along with tree-formed serviceberry *(Amelanchier alnifolia)* or Russian hawthorn *(Crataegus ambigua)*, if planting for low water usage. The table provides more information on height, spread, and water requirements.

A Vegetables Sampler

by Knobby Brown, Chairman

Nothing can compare with the sense of pride and achievement of harvesting homegrown vegetables. Presenting them to family and friends is gratifying. The advantages of growing them yourself are many. They can be harvested at the peak of perfection and ripeness. Chemical sprays can be limited or eliminated entirely. Varieties for the home gardener are almost always more delicious, as they are chosen for taste, not for their shipping qualities. The table offers a complete listing of vegetables.

The varieties in this division are tried-and-true and have been tested for success in Colorado. Many varieties are space-saving bush types rather than vining varieties. These plants are early maturing, prolific producers, disease-resistant and decorative, not to mention delicious.

The best site for a vegetable garden is a sunny one and the soil should be fertile and free-draining. Adding humus, in the form of peat moss, compost, or well-rotted manure, will improve growth and ensure better production. Colorado gardeners have found that mulching is the primary aid in saving water and in keeping weeds between rows to a minimum. Thin layers of grass clippings, straw, sawdust and wood shavings, and half-rotted leaves are effective mulches.

Since these plants are greenhouse grown, they should be hardened-off before being set out in the garden. Find a protected outdoor area, especially from the wind, and gradually move the plants to a sunnier spot each day; after being exposed fully for a few days, plants may be transplanted into a prepared bed.

There are certain vegetable varieties which have stood the test of time and would qualify as Colorado classics. My five personal favorites include 'Celebrity' tomato, with first-rate flavor, color, and texture, as well as disease resistance; 'Green Duke' broccoli, which produces a central head early in the season and an abundance of smaller heads on the lateral branches until late fall; and 'Dusky' eggplant, an early-maturing, very productive variety with medium-sized glossy purple fruits. 'New Ace' pepper produces a good crop of medium-sized peppers on short sturdy plants. They may be picked while green, or allowed to mature to bright red. 'Sweet Success' cucumber is a vigorous producer of long, uniform, dark-green fruit with very few seeds. The flavor is delicious, without a trace of bitterness, and slices can be eaten skin and all.

There are some new introductions that appear to have a promising future in our area. 'Bushkin' pumpkin is a triple-purpose bush variety for cooking, canning, and seed snacks. Par-cel is a plant that looks like a large-leaf parsley but has the flavor and aroma of celery. The leaves can be used in salads, for flavoring soups, or for garnish that won't be left on the plate. 'Oriole' pepper is a sweet bell pepper that ripens from green to a glowing orange. These may well be the future classics of the Colorado vegetable garden.

Water Gardening in Colorado

by Len Freestone, Chairman

Water lilies are easy to grow and require very little attention during the growing season. By selecting healthy rhizomes and following a few simple planting instructions, lilies will bloom from June through September, depending on altitude and weather conditions. The higher the altitude, the shorter the growing season: for example, at 7,000 feet, they will bloom from late June through late August. Most hardy lilies require at least four to six hours of full sun, but some varieties will produce blooms in as little as three hours of sunshine. The table outlines additional information.

The larger the container, the better the results. Use at least a 10 to 12 inch diameter pot, or better yet, a shallow rectangular pan 12 x 16 x 5 inches. Fill the container half-full with good garden soil (some clay is helpful, but do not use potting soil) but do not cover the crown. If the pool gets only four hours of full sun the water depth should not be more than six inches. Fertilize monthly, May through September, with tablets or granular fertilizer. Tablets should be pushed into a depth of about four inches, or granules may be wrapped in a piece of newspaper and inserted to about the same depth.

The soil requirements for bog plants are the same as for water lilies, except that only half the fertilizer should be used, and containers should be suited to the size of the plant. Many bog plants will grow either in very wet soil or in a pool. Tropical bog plants will not survive Colorado winters oudoors but plants such as papyrus, canna, and umbrella palm may be used as house plants if the container is placed in water up to the level of the soil surface.

A properly balanced pool needs both plants and fish to ensure clear, healthy water. Potted plants such as water lilies and bog plants, floating plants, and water moss should occupy approximately one-half of the water surface. Plants reduce algae by competing with the algae for nutrients. They also provide both oxygen and hiding places for the fish.

In most parts of the country, 20 inches is a good depth for a pool, however, in Colorado, consider a water depth of 24 to 30 inches to store hardy water lilies over winter. Other methods can be used, but the basic requirements are the same: lilies must be allowed to go dormant, and should be kept moist in a cool location (50° F maximum) where their roots will not freeze. The method involving the least amount of work requires a pond at least two feet deep. After the first frost, remove all leaves and stems from the plant and lower the pot to the bottom of the pond. If the pond contains fish, it must not be allowed to freeze over completely. There must be a hole in the ice to allow gases to escape. A submersible pump with the outlet pointing toward the surface will create enough surface movement to prevent complete freezing. In a pool without a pump, use hot water to make a hole in the ice, them remove enough water to lower the water level by about one to six inches and fill the hole with rags to slow down freezing. Check the pond regularly to make sure the hole has not re-sealed. Do not make a hole in the ice with a hammer. Hammering will harm the fish. If the pond is not deep enough or must be drained for the winter, remove the pots, prune dead leaves and stems, place pots in plastic bags to retain moisture, and store them in a cool basement.

Table 1, Annuals.
Joedy Arnold, and Sheila Stephens, Chairmen.

[**HT** (height): in inches (Vn=vine); **SP** (Spread): in inches (spacing); **TYP** (type): B=Bedding, C=Cutting, D=Drying, F=Fragrant; **SL** (soil): 1=acid peat, 9=alkaline clay; **SN** (sun): 1=full shade, 9=full sun; **WT** (water): 1=wet, 9=dry]

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	Sl	WT
Achillea millefolium 'Summer Pastels'	Yarrow	Mix	15	10	B,C,D	9	5	4
Ageratum houstonianum 'Pink'	Floss Flower	Pink	8	8	B	5	5	5
Ageratum houstonianum 'Blue Danube'	Floss Flower	Blue	6	8	B	5	5	5
Ageratum houstonianum 'Blue Horizon'	Floss Flower	Blue	30	22	B,C	5	5	5
Ageratum houstonianum 'Blue Puffs'	Floss Flower	Blue	5	9	B	5	5	5
Ageratum houstonianum 'Capri'	Floss Flower	Blue	12	10	B,C	5	5	5
Ageratum houstonianum 'Cut Wonder'	Floss Flower	Blue	18	12	B,C	5	5	5
Ageratum houstonianum 'Snow Ball'	Floss Flower	White	8	8	B	5	5	5
Ageratum houstonianum 'Southern Cross'	Floss Flower	Wt/Bl	8	8	B	5	5	5
Agrostemma githago 'Milas'	Corn Cockle	Pink	24	12	B,C,D	9	5	5
Agrostemma githago 'Purple Queen'	Corn Cockle	Purple	24	12	B,C,D	9	5	5
Agrostis nebulosa	Cloud Grass	Grass	18	10	B,C,D	7	5	7
Alonsoa warscewiczii	Mask Flower	Orange	18	16	B,C	7	5	5
Althaea rosea 'Pinafore'	Hollyhocks	Mix	36	14	B	9	5	5
Althaea rosea 'Powderpuff	Hollyhocks	Mix	36	14	B	9	5	5
Amaranthus tri-color 'Early Splendor'	Joseph's Coat	Rd/Choc	30	24	B	9	5	5
Ammi majus	False Q. Anne's Lace	White	30	24	B,C	7	5	5
Ammobium alatum	Winged Everlasting	Silver	20	12	B,C,D	9	5	5
Anethum graveolens 'Vierling'	Flowering Dill	Gn\Wht	30	24	B,C	7	5	5
Antirrhinum majus 'Floral Shower'	Snapdragon	Mix	6	10	B	7	5	5
Antirrhinum majus 'Madame Butterfly'	Snapdragon	Mix	26	12	B,C	7	5	5
Antirrhinum majus 'Rocket Tahiti Pink'	Snapdragon	Pink	7	10	B	7	5	5
Antirrhinum majus 'Sonnet Series'	Snapdragon	Mix	18	12	B,C	7	5	5
Antirrhinum majus 'Tahiti Mix'	Snapdragon	Mix	7	7	B	7	5	5
Antirrhinum majus 'Wedding Bells'	Snapdragon	Mix	26	12	B,C	7	5	5
Antirrhinum majus 'Rocket Mix'	Snapdragon	Mix	24	12	B,C	7	5	5
Antirrhinum majus 'Rocket White'	Snapdragon	White	24	12	B,C	7	5	5
Antirrhinum majus 'Rocket Yellow'	Snapdragon	Yellow	24	12	B,C	7	5	5
Antirrhinum majus 'Sweet Heart'	Double Snapdragon	Mix	10	10	B,C	7	5	5
Arctotis stoechadifolia	African Daisy	Mix	24	24	B	9	5	7
Asparagus densiflorus 'Sprengeri'	Asparagas Fern	Green	14	14	B	7	5	3
Begonia x *semperflorens* 'Clips'	Wax Begonia	Assort.	8	8	B	6	5	3
Begonia x *semperflorens* 'F.R. Dwarf'	Wax Begonia	Mix	6	6	B	7	5	3
Begonia x *semperflorens* 'Happy End'	Wax Begonia	Mix	8	6	B	6	5	3
Bougainvillea x	Bougainvillea	Pk, Org	VN	--	--	7	5	3
Brachycome iberifolia	Swan River Daisy	Purple	10	12	B	5	5	5
Brassica oleracea acephala	Flowering Kale	Multi.	12	10	B	9	5	5
Brassica oleracea capitata	Flowering Cabbage	Multi.	10	12	B	9	5	5
Briza maxima	Big Quaking Grass	Grass	24	12	B,C,D	7	5	7
Briza minor	Little Quaking Grass	Grass	12	10	B,C,D	7	5	7
Bromus lanceolatus	Brome Grass	Grass	24	18	B,C,D	7	5	7
Browallia speciosa 'Jingle Bells'	Sapphire Flower	Mix	9	12	B	7	5	5
Browallia speciosa 'Marine Bells'	Sapphire Flower	Blue	9	12	B	7	5	5
Browallia speciosa 'Silver Bells'	Sapphire Flower	White	9	12	B	7	5	5
Bupleurum routundifolium 'Griffittii'	Bupleurum	Green	12	12	B	9	5	5
Calendula officinalis 'Bon Bon Orange'	Pot Marigold	Orange	8	8	B	9	5	5
Calendula officinalis 'Fiesta Gitana'	Pot Marigold	Mix	12	10	B	9	5	5

Table 1. Annuals, continued...

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	SI	WT
Calendula officinalis 'Indian Song'	Pot Marigold	Yellow	20	12	B,C	9	5	5
Callistephus chinensis 'Dwarf Mix'	Aster	Mix	8	6	B	9	5	5
Callistephus chinensis 'Early Ostrich Plume'	Aster	Mix	18	9	B,C	9	5	5
Callistephus chinensis 'Pinnochio'	Aster	Mix	6	8	B	9	5	5
Callistephus chinensis 'Pot+Patio'	Aster	Mix	6	9	B	9	5	5
Callistephus chinensis 'Tall Mix'	Aster	Mix	24	12	B,C	9	5	5
Calonyction aculeatum	Moon Vine	White	VN	--	F	7	5	4
Carthamus tinctorius 'Goldtuft'	Golden Safflower	Gld org	30	14	B,C,D	9	5	5
Catharanthus roseus 'Carpet'	Vinca	Mix	3	24	B	5	5	8
Catharanthus roseus 'Little Cooler Series'	Vinca	Mix	8	8	B	5	5	8
Catharanthus roseus 'Little Series'	Vinca	Wh,Rs,Pk	8	8	B	5	5	8
Catharanthus roseus 'Sahara Madness'	Vinca	Pink	10	8	B	5	5	8
Celosia cristata 'Century Mix'	Celosia	Mix	22	12	B,C,D	9	5	5
Celosia cristata 'Coral Garden'	Cockscomb	Mix	10	10	B,C,D	9	5	5
Celosia cristata 'Forest Fire'	Celosia	Red	18	12	B,C,D	9	5	5
Celosia cristata 'New Look'	Celosia	Scarlet	10	10	B,C,D	9	5	5
Celosia cristata 'Pink Castle'	Celosia	Pink	20	10	B,C,D	9	5	5
Celosia cristata 'Yellow Castle'	Celosia	Yellow	10	10	B,C,D	9	5	5
Centaurea cyanus 'Blue Boy'	Bachelor's Button	Blue	30	20	C,D	9	5	5
Centaurea cyanus 'Polka Dot'	Bachelor's Button	Mix	15	12	C,D,F	9	5	5
Centaurea moschata	Sweet Sultan	Mix	24	2	B	9	5	5
Centaurea moschata 'The Bride'	Sweet Sultan	White	16	18	C	9	5	5
Chrysanthemum carinatum 'Court Jester'	Annual Mum	Multi	18	12	B,C	9	5	7
Chrysanthemum carinatum 'Rainbow'	Annual Mum	Multi	24	16	B,C	9	5	7
Chrysanthemum coronarium 'Primrose Gem'	Garland Mum	Lt. Yel	12	16	B,C	9	5	5
Chrysanthemum frutescens	Marguerite Daisy	Yel, Wht	18	12	B	9	5	5
Chrysanthemum multicaule	Annual Mum	Yellow	4	10	B	9	5	5
Chrysanthemum paludosum	Annual Mum	White	4	10	B	9	5	5
Chrysanthemum parthenium 'Bridal Robe'	Feverfew	White	24	14	B,C	9	5	5
Clarkia amoena 'Dwarf Mix'	Dwarf Godetia	Mix	12	8	B,C	5	7	3
Clarkia amoena 'Tall Mix'	Godetia	Mix	24	10	B,C	5	7	3
Cleome hasslerana 'Cherry Queen'	Spider Flower	Pink	48	20	B,C	9	5	5
Cleome hasslerana 'Queen Mix'	Spider Flower	Mix	48	20	B,C	9	5	5
Cleome hasslerana 'White Queen'	Spider Flower	White	48	18	B,C	9	5	5
Coleus x 'Verigated'	Coleus	Verig.	12	10	B	4	5	4
Coleus x 'Black Tall'	Coleus	Drk Mix	10	8	B	4	5	4
Collinsia heterophylla	Chinese Houses	Lavender	18	20	B	5	5	3
Collomia cavanillessi 'Neon'	Collomia	Scarlet	20	10	B,C	9	5	5
Consolida ambigua 'Blue Cloud'	Field Larkspur	Blue	30	18	C,D	7	5	5
Consolida ambigua 'Dwarf Hyacinth'	Rocket Larkspur	Pk/Vio	12	8	C,D	7	5	5
Consolida ambigua 'Giant Imperial Mix'	Field Larkspur	Mix	36	18	C,D	7	5	5
Consolida ambigua 'Imperial White King'	Field Larkspur	White	36	18	C,D	7	5	5
Convolvulus tricolor 'Variegated'	Bush Dwarf Morning Glory	Mix	5	8	B	9	5	5
Coreopsis tinctoria	Coreopsis, Tickseed	Yel/Mahg	24	10	B	7	5	5
Cosmos bipinnatus 'Seashell'	Cosmos	Mix	48	18	B,C	9	5	7
Cosmos bipinnatus 'Sensation'	Cosmos	Mix	48	18	B,C	9	5	5
Cosmos sulphureus 'Bright Lights'	Cosmos	Gld/Rd	30	16	B,C	9	5	5
Cosmos sulphureus 'Diablo'	Cosmos	Scrl/Org	40	24	B,C	9	5	5
Cosmos sulphureus 'Lemon Twist'	Cosmos	Yellow	26	68	B,C	9	5	5
Cosmos sulphureus 'Sunny Gold'	Cosmos	Gold	12	10	B,C	9	5	5
Cosmos sulphureus 'Sunny Mix'	Cosmos	Mix	12	10	B,C	9	5	5

Table 1. Annuals, continued...

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	SI	WT
Cosmos sulphureus 'Sunny Red'	Cosmos	Red	12	10	B,C	9	5	5
Crepis rubra	Hawk's Beard	Pink	15	16	B,C	9	5	5
Crepis rubra 'Snowplume'	Hawk's Beard	White	8	14	B,C	9	5	5
Cuphea ignea	Cigar Plant	Orange	12	10	B	9	5	3
Cynoglossum amabile	Chinese Forget-me-not	Turq	18	14	B,F	7	5	5
Dahlia x 'Opera Dwarf Mix'	Dahlia	Mix	10	8	B	9	3	3
Dahlia x 'Redskin'	Dahlia	Mix	15	10	B	9	3	3
Delphinium 'Magic Fountain'	Dwarf Delphinium	Mix	30	18	B,C	7	5	5
Dianthus barbatus 'Wee Willie'	Sweet William	Mix	6	6	B,F	7	5	5
Dianthus caryophyllus	Carnation	Mix	12	10	B,C	7	5	5
Dianthus chinensis 'Frosty Mix'	Pinks	Bicolor	12	12	B,C,F	7	5	5
Dianthus chinensis 'Princess'	Sweet William	Mix	8	12	B,F	7	5	5
Dianthus chinensis 'Snow Carpet'	Sweet William	White	8	8	B,F	7	5	5
Dianthus chinensis 'Telestar Picotee'	Sweet William	Red	10	10	B,F	7	5	5
Diascia barberae	Twinspur	Pink	10	8	B	7	5	6
Dracaena	Spike Dracena	--	36	24	B	7	5	5
Dyssodiaenuiloba 'Golden Fleece'	Dahlberg Daisy	Yellow	8	8	B	9	5	5
Emilia jauanica 'Scarlet Magic'	Tassel Flower	Scarlet	18	6	B,C,D	8	5	5
Eragrostis elegans	Love Grass	Grass	36	24	B,C,D,F	7	5	7
Eschschozia californica 'California Mix'	California Poppy	Mix	9	9	B	9	5	8
Eschschozia californica 'California Orange'	Poppy, California	Orange	18	12	B	9	5	8
Euphorbia marginata	Snow-on-the-Mountain	White	36	24	B	9	5	5
Europs	Yellow Daisy	Yellow	10	20	B	8	5	3
Eustoma grandiflorum 'Lion Mix'	Prairie Gentian	Mix	14	8	B,C	9	5	6
Eustoma grandiflorum 'Yodel Mix'	Prairie Gentian	Mix	14	8	B,C	9	5	6
Fuchsia x *hybrida*	Upright Fuchsia	Assort.	18	12	B	2	4	2
Fuchsia x *hybrida*	Trailing Fuchsia	Assort.	12	12	B	2	4	2
Gazania ringens 'Chansonette'	Gazania	Mix	6	6	B	9	5	7
Gomphrena globosa 'Buddy'	Globe Amaranth	Magenta	6	6	B,C,D	7	5	7
Gomphrena globosa 'Strawberry Fields'	Globe Amaranth	Red	18	20	B,C,D	7	5	7
Gomphrena globosa 'Woodcreek Mix'	Globe Amaranth	Mix	14	10	B,C,D	7	5	7
Gypsophila elegans	Annual Baby's Breath	Mix	18	12	B,C,D	8	5	4
Gypsophila elegans 'Covent Garden	Annual Baby's Breath	White	18	12	B,C,D	8	5	4
Helianathus annuus 'Color Fashion Mix'	Sunflower	Yel/Brzn	72	36	B,C	9	5	5
Helianathus annuus 'Italian White'	Sunflower	Cream	48	36	B,C	9	5	5
Helianathus annuus 'Luna'	Sunflower	Lt Yel	60	42	B,C	9	5	5
Helichrysum bracteatum 'King Mix'	Strawflower	Mix	36	24	B,C,D	8	5	5
Helichrysum bracteatum 'Monstrosum'	Strawflower	Mix	24	12	B,C,D	7	5	5
Heliotropium arborescens 'Arbore'	Heliotrope	Violet	15	10	B,C,F	5	5	5
Heliotropium arborescens 'Marine'	Heliotrope	Violet	15	10	B,C,F	5	5	5
Hibiscus moscheutos 'Disco Belle White'	Rose Mallow	White	24	28	B	9	5	3
Iberis amara 'Iceberg'	Candytuft	White	8	10	B,C,F	7	5	5
Iberis umbellata 'Dwarf Fairy'	Candytuft	Mix	8	10	B,C,F	7	5	5
Impatiens balsamina	Balsam	Mix	9	6	B	7	5	5
Impatiens x 'Accent'	Impatiens	Mix	15	20	B	3	3	5
Impatiens x 'Blitz'	Impatiens	Mix	15	20	B	3	3	5
Impatiens x 'Cascade Beauty'	Impatiens	Mix	15	20	B	3	3	5
Impatiens x 'Dazzle'	Impatiens	Cranberry	18	20	B	3	3	5
Impatiens x 'Novette Stars'	Impatiens	Mix	10	12	B	3	3	5
Impatiens x 'Super Elfin Blue Pearl'	Impatiens	Lavender	10	12	B	3	3	5
Impatiens x 'Super Elfin Lipstick'	Impatiens	Red	10	12	B	3	3	5

Table 1. Annuals, continued...

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	SI	WT
Impatiens x 'Super Elfin Parfait'	Impatiens	Magenta	10	12	B	3	3	5
Impatiens x 'Super Elfin Pearl'	Impatiens	Lilac	10	12	B	3	3	5
Impatiens x 'Super Elfin Pink'	Impatiens	Pink	10	12	B	3	3	5
Impatiens x 'Super Elfin Red Velvet'	Impatiens	Red	10	12	B	3	3	5
Impatiens x 'Super Elfin Salmon Blush'	Impatiens	Salmon	10	12	B	3	3	5
Impatiens x 'Super Elfin Star Mix'	Impatiens	Mix	12	12	B	3	3	5
Impatiens x 'Super Elfin Twilight'	Impatiens	White	10	12	B	3	3	5
Impatiens x 'Super Elfin Violet'	Impatiens	Violet	10	12	B	3	3	5
Impatiens x 'Super Elfin White'	Impatiens	White	10	12	B	3	3	5
Ipomoea purpurea 'Early Call'	Morning Glory	Mix	VN	--	B	9	5	5
Ipomoea purpurea 'Heavenly Blue'	Morning Glory	Blue	VN	--	B	9	5	5
Ipomoea purpurea 'Scarlet O'Hara'	Morning Glory	Red	VN	--	B	9	5	5
Ipomoea purpurea 'Spice Island'	Morning Glory	Mix	VN	--	B	9	5	5
Ipomoea quamoclit 'Relli-Valley'	Cypress Vine	Mix	VN	--	B	5	5	3
Kochia scoparia trichophylla	Summer Cypress	--	36	12	B	9	6	6
Lasthenia glabrata	Goldfields	Yellow	9	16	B	6	5	5
Lathyrus odoratus 'Mamoth Series'	Sweet Pea	Mix	VN	6'	B,C,F	7	5	5
Lathyrus odoratus 'Old Spice'	Sweet Pea	Mix	VN	6'	B,C,F	7	5	5
Lathyrus odoratus 'Painted Lady'	Sweet Pea	Mix	VN	6'	B,C,F	7	5	5
Lathyrus odoratus 'Patio'	Sweet Pea	Mix	9	6	B,C,F	7	5	5
Lavatera trimestris 'Mont Blanc'	Lavatera, Tree Mallow	White	18	12	B	9	5	5
Lavatera trimestris 'Silver Cup'	Lavatera, Tree Mallow	Pink	18	12	B	9	5	5
Limnanthes douglasii	Fried Eggs	Gold	6	9	B	9	5	5
Limonium bellidifolium	Statice	Lavender	36	24	B,C,D	8	2	7
Limonium sinnatum 'Art Shade'	Statice	Mix	24	12	B,C,D	9	2	7
Limonium sinuatum 'Petite Bouquet'	Statice	Mix	12	8	B,C,D	8	2	7
Limonium sinuatum 'Soiree'	Statice	Mix	24	12	B,C,D	9	2	7
Limonium suworowii	Statice	Pink	18	12	B,C,D	9	2	7
Linaria reticulata 'Crown Jewels'	Toadflax	Assort.	6	9	B,C	7	5	5
Linum grandiflorum 'Bright Eyes'	Annual Flax	White	14	12	B	9	5	5
Linum grandiflorum 'Scarlet'	Annual Flax	Red	16	12	B	9	5	5
Lobelia erinus 'Blue Moon'	Edging Lobelia	D Violet	4	4	B	7	5	4
Lobelia erinus 'Color Cascade'	Trailing Lobelia	Mix	4	15	B	7	5	5
Lobelia erinus 'Crystal Palace'	Edging Lobelia	Dp Blue	4	4	B	7	5	5
Lobelia erinus 'Fountain Mix'	Trailing Lobelia	Mix	4	4	B	7	5	5
Lobelia erinus 'Royal Mix'	Edging Lobelia	Mix	4	4	B	7	5	5
Lobelia erinus 'Sapphire'	Trailing Lobelia	Dp Blue	4	15	B	7	5	5
Lobelia erinus 'White Lady'	Edging Lobelia	White	4	4	B	7	5	5
Lobelia erinus 'White Trailing'	Trailing Lobelia	White	4	15	B	7	5	5
Lobularia maritima 'Easter Bonnet'	Sweet Allysum	Mix	3	8	B	7	5	5
Lobularia maritima 'Wonderland Rose'	Sweet Allysum	Rose	3	8	B	7	5	5
Lobularia maritima 'Wonderland White'	Sweet Allysum	White	3	8	B	7	5	5
Lonas annua	Lonas, Yellow Ageratum	Gld-yel	10	8	B,C,D	7	5	5
Lupinus 'Galaxy'	Lupine							
Lupinus texensis	Texas Bluebonnet	Blue	10	10	B	9	5	5
Malope trifida	Mallow	Wt/Prp	26	12	B,C	9	5	5
Mathiola incana bicornis	Night Scented Stock	Lilac	10	8	B,C,F	7	5	5
Mathiola incana 'Midget Series'	Dwarf Dbl Stock	Mix	10	8	B,C,F	7	5	5
Mathiola incana 'Trysomic 7 Week'	Dwarf Dbl Stock	Mix	8	4	B,C,F	7	5	5
Melampodium paludosum	Melamopodium	Yellow	18	10	B	9	5	8
Mesembryanthemum criniflorum 'Livingston'	Annual Ice Plant	Pink	3	12	B	9	8	8

Table 1. Annuals, continued...

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	SI	WT
Mesembryanthemum criniflorum 'Lunette'	Annual Ice Plant	Yel/Red	2	12	B	9	8	8
Mimulus x 'Calypso'	Monkey Flower	Mix	10	8	B	7	5	5
Mirabilis jalapa	Four-O'clock	Mix	24	20	B,C,F	7	5	5
Moluccella laevis	Bells-of-Ireland	Green	30	12	B,C,D	7	5	5
Myosotis sylvatica	Forget-me-not	Blue	10	6	B	5	5	4
Nemesia strumosa 'Carnival'	Nemesia	Mix	12	6	B,C	7	5	3
Nemesia strumosa 'Mello'	Nemesia	Rd/Wt	12	6	B,C	7	5	3
Nicotiana alata	Tall Flowering Tobacco	White	48	15	B	7	5	5
Nicotiana alata 'Domino Purple'	Flowering Tobacco	Purple	12	10	B	7	5	5
Nicotiana alata 'Domino White'	Flowering Tobacco	White	12	10	B	7	5	5
Nicotiana alata 'Nicki Lime Green'	Flowering Tobacco	Lm Grn	24	12	B	7	5	5
Nicotiana alata 'Nicki Pink'	Flowering Tobacco	Pink	12	10	B	7	5	5
Nicotiana alata 'Nicki Red'	Flowering Tobacco	Red	12	10	B	7	5	5
Nicotiana alata 'Nicki White'	Flowering Tobacco	White	12	10	B	7	5	5
Nicotiana sylvestris	Candelabra Flwr Tobacco	White	48	18	B,F	7	5	5
Nierembergia hippomanica 'Purple Robe'	Cup Flower	Purple	8	8	B	7	5	5
Nigella damascena 'Mulberry Rose'	Love-in-a-Mist	Rose	14	10	B,C,D	7	5	7
Nigella damascena 'Persian Jewel'	Love-in-a-Mist	Mv/Lav	14	10	B,C,D	7	5	7
Nolana paradoxa	Nolana	Blue	6	10	B	9	7	8
Osteospermum jacundum	Dimorphotecha	Mix	12	12	B	9	5	7
Osteospermum hyoseroides 'Gaiety'	Tripteris	Orange	18	16	B	9	5	7
Osteospermum jacundum 'Star Shine'	African Daisy	Rd/Wht	12	12	B	9	5	7
Papaver rhoeas 'Flanders'	Flanders Poppy	Red	18	9	B,C	9	5	5
Papaver rhoeas 'Shirley Mix'	Shirley Poppy	Mix	18	12	B	8	5	5
Pelargonium peltatum	Ivy Geranium	Assort.	6	18	B	7	5	3
Pelargonium peltatum 'Balcon'	Ivy Geranium	Assort.	6	18	B	7	5	3
Pelargonium peltatum 'Decora'	Ivy Geranium	Assort.	6	18	B	7	5	3
Pelargonium peltatum 'Summer Showers'	Ivy Geranium	Assort.	6	18	B	7	5	3
Pelargonium x *hortorum* 'Multibloom Pink'	Geranium	Pink	8	6	B	8	5	5
Pelargonium x *hortorum* 'Multibloom Salmon'	Geranium	Salmon	8	6	B	8	5	5
Pelargonium x *hortorum* 'Multib. Scarlet Eye'	Geranium	Wt/Scar	8	6	B	8	5	5
Pelargonium x *hortorum* 'Multibloom Scarlet'	Geranium	Scarlet	8	6	B	8	5	5
Pelargonium x *hortorum* 'Multibloom White'	Geranium	White	8	6	B	7	5	5
Pelargonium x *hortorum* 'Orbit Hot Pink'	Geranium	Pink	14	10	B	8	5	5
Pelargonium x *hortorum* 'Orbit Red'	Geranium	Red	14	10	B	8	5	5
Pelargonium x *hortorum* 'Ogilvie'	Geranium	Red	10	6	B	8	5	5
Pelargonium x *hortorum* 'Zonal'	Geranium	Assort.	16	10	B	8	5	5
Pennisetum ruppelii	Fountain Grass	Grass	48	30	B,C,D	7	5	7
Pennisetum villosum	Dwarf Feather Top Grass	Grass	24	12	B,C,D	7	5	7
Pentzia 'Gold Button'	Pentzia	Yellow	24	18	B,C,D	7	5	7
Petunia x 'Azure Pearls'	Petunia	Blue	8	12	B	8	5	5
Petunia x 'Bicolor Mix'	Petunia	Mix	8	12	B	8	5	5
Petunia x 'Bridal Bouquet'	Petunia	White	8	12	B	8	5	5
Petunia x 'Bride's Maid'	Petunia	Dk. Purple	8	12	B	8	5	5
Petunia x 'Can Can Mix'	Petunia	Mix	8	12	B	8	5	5
Petunia x 'Cascading Salmon'	Petunia	Salmon	8	12	B	8	5	5
Petunia x 'Cascading White'	Petunia	White	8	12	B	8	5	5
Petunia x 'Fluf Ruf Mix'	Petunia	Mix	8	12	B	8	5	5
Petunia x 'Laser Series'	Petunia	Assort.	8	12	B	8	5	5
Petunia x 'Pearls'	Petunia	Assort.	8	12	B	8	5	5
Petunia x 'Polo Burgundy Star'	Petunia	Burgundy	8	12	B	8	5	5

Table 1. Annuals, continued...

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	Sl	WT
Petunia x 'Strawberry'	Petunia	Red	8	12	B	8	5	5
Petunia x 'Summer Madness'	Petunia	Pink	8	12	B	8	5	5
Petunia x 'Tahitian Sails'	Petunia	Salmon	8	12	B	8	5	5
Petunia x 'Yellow Magic'	Petunia	Yellow	8	12	B	8	5	5
Phacelia campanularia	California Bluebell	Blue	9	9	B,F	5	7	5
Phalaris canariensis	Canary Grass	Grass	18	12	B,C,D	7	5	7
Phaseolus coccineus	Scarlet Runner Bean	Red	VN	--	B	9	4	3
Phlox drummondii 'Cecily'	Drummond's Phlox	Mix	6	6	B,C	9	5	5
Phlox drummondii 'Petticoat'	Drummond's Phlox	Mix	4	6	B,C	9	5	5
Polypogon monspeliensii	Rabit's Foot Grass	Grass	25	18	B,C,D	7	5	7
Portulaca grandiflora 'Sundial'	Moss Rose	Mix	6	8	B	9	5	7
Portulaca grandiflora 'Swan Lake'	Moss Rose	White	6	8	B	9	5	7
Portulaca grandiflora 'Wildfire'	Moss Rose	Mix	6	14	B	9	5	7
Primula x *polyanthus*	Primrose	Assort.	8	6	B	4	5	3
Primula malacoides	Primrose	Assort.	8	6	B	4	5	3
Reseda odorata 'Grandiflora'	Mignonette	Cream	24	12	C,F	7	5	5
Reseda odorata 'Machet'	Mignonette	Red	12	10	C,F	7	5	5
Rhodochiton atrosanguineum	Purple Bells	Maroon	VN	--	B	7	5	5
Ricinus communis 'Impala'	Castor Bean	Yellow	60	40	B	7	5	5
Rudbeckia hirta 'Goldilocks'	Gloriosa Daisy	Yellow	20	18	B,C	9	5	5
Rudbeckia hirta 'Irish Eyes'	Gloriosa Daisy	Yl/Gn	28	20	B,C	9	5	5
Ryhnchecetrum repens	Ruby Grass	Grn/Rose	18	16	B,C	7	5	5
Salpiglossis sinuata 'Casino'	Painted Tongue	Mix	10	8	B,C	5	5	3
Salpiglossis sinuata 'Splash'	Painted Tongue	Mix	22	18	B,C	5	5	3
Salvia farinacea 'Argent'	Mealycup Sage	White	18	12	C	7	5	5
Salvia farinacea 'Blue Bedder'	Mealycup Sage	Blue	18	12	C	7	5	5
Salvia farinacea 'Victoria'	Mealycup Sage	Blue	24	12	B,C,D	9	5	5
Salvia splendens 'Caribiniere Purple'	Salvia	Purple	10	8	B	9	5	5
Salvia splendens 'Caribiniere Scarlet King'	Salvia	Red	10	8	B	9	5	5
Salvia splendens 'Caribiniere White'	Salvia	White	10	8	B	9	5	5
Salvia splendens 'Rhea'	Salvia	White	12	8	B	9	5	5
Salvia splendens 'Stripes'	Salvia	Wt/Rd	16	10	B	9	5	5
Salvia splendens 'White'	Salvia	White	14	8	B	9	5	5
Sanvitalia procumbens 'Gold Braid'	Creeping Zinnia	Gold	6	9	B	9	5	5
Scabiosa atropurpurea 'Giant Imperial'	Pincushion Flower	Lt Blue	24	18	B,C,D	9	5	8
Scabiosa stellata'Ping Pong'	Pincushion Flower	White	18	14	B,C,D	9	5	8
Schizanthus wisetonensis 'Angel Wings'	Butterfly Flower	Bl/Pk	18	14	B,C	9	5	5
Senecio maritima 'Cirrus'	Dusty Miller	Silver	8	10	B	7	5	7
Senecio maritima 'New Look'	Dusty Miller	Silver	9	12	B,C,D	7	5	7
Senecio maritima 'Silver Feather'	Dusty Miller	Silver	12	10	B	7	5	7
Senecio maritima 'Silver Queen'	Dusty Miller	Silver	8	6	B	7	5	7
Setaria macrochaeta	Weeping Bristle Grass	Grass	48	30	B,C,D	7	5	7
Silene oculata 'Royal Angel'	Catch Fly	Blue	10	10	B,C	7	5	5
Sorghum bicolor	Black Millet	Grass	60	12	B,C,D	7	5	7
Tagetes erecta 'Crackerjack'	Marigold	Assort.	24	16	B,C	9	5	5
Tagetes erecta 'Primrose Lady'	Marigold	Lt. Yellow	16	10	B,C	9	5	5
Tagetes erecta 'Snowbird'	Marigold	White	16	10	B,C	9	5	5
Tagetes tenuifolia pumila 'Discovery Yellow'	Marigold	Yellow	10	10	B	9	5	5
Tagetes tenuifolia pumila 'Golden Gem '	Marigold	Gold	8	10	B	9	5	5
Tagetes tenuifolia pumila 'Lemon Gem'	Marigold	Lemon	8	10	B	9	5	5
Tagetes tenuifolia pumila 'Ginger'	Marigold	Gold	10	10	B	9	5	5

Table 1. Annuals, continued...

LATIN NAME	COMMON NAME	COLOR	HT	SP	TYP	S	SI	WT
Tagetes tenuifolia pumila 'Golden Gate'	Marigold	Gold/Rd	14	12	B	9	5	5
Tagetes tenuifolia pumila 'Saffron'	Marigold	Yellow	10	8	B	9	5	5
Tagetes tenuifolia pumila 'Star Fire'	Marigold	Mix	6	8	B	9	5	5
Tagetes tenuifolia pumila 'Tiger Eyes'	Marigold	Scarlet	12	12	B	9	5	5
Talinum crassifolium	Jewels of Opar	Dp Pink	20	12	B,C	7	5	5
Thunbergia alata	Black-Eyed Susan Vine	Mix	VN	--	B	7	5	5
Tithonia rotundifolia 'Torch'	Mexican Sunflower	Orange	26	24	B,C	7	5	5
Torenia fournieri	Wishbone Flower	Blue	8	8	B	3	5	3
Torenia fournieri 'Clown Mix'	Wishbone Flower	Mix	8	8	B	3	5	3
Trachymene caerulea	Blue Lace Flower	Lt Blue	24	12	C,D	7	5	5
Triticum turgidum 'Wakooma'	Bearded Wheat Grass	Grass	48	30	B,C,D	7,57		
Tropaeolum majus 'Fragrant Giants'	Trailing Nasturtium	Org/Scrl	VN	--	B	9	5	7
Tropaeolum majus 'Jewel Mix'	Nasturtium	Mix	12	8	B,C,F	9	7	5
Tropaeolum majus 'Whirlybird Cherry Rose'	Trailing Nasturtium	Red	12	8	B,C,F	9	7	5
Tropaeolum majus 'Whirlybird Gold'	Nasturtium	Gold	12	8	B,C,F	9	7	5
Tropaeolum majus 'Whirlybird Mahogany'	Nasturtium	Mahogany	12	8	B,C,F	9	7	5
Tropaeolum majus 'Whirlybird Scarlet'	Nasturtium	Red	12	8	B,C,F	9	7	5
Tropaeolum majus 'Whirlybird Tangerine'	Nasturtium	Orange	12	8	B,C,F	9	7	5
Tropaeolum peregrinum 'Canary Bird'	Canary Creeper	Yellow	VN	--	B,C,F	9	7	5
Venidium fastuosum	Monarch of the Veldt	Org/Prp	24	20	B,C	9	5	5
Verbena bonariensis	Verbena	Lavender	40	20	B,C	9	5	5
Verbena hortensis 'French Blue'	Verbena	Blue	10	8	B,C	9	5	5
Verbena hortensis 'Novalis Series'	Verbena	Assort.	10	8	B,C	9	5	5
Verbena hortensis 'Sandy White'	Verbena	White	10	8	B,C	9	5	5
Verbena rigida	Verbena	Purple	12	10	B,C,F	9	5	7
Vinca major variegata	Trailing Vinca	--	VN	--	B	7	5	5
Viola wittrockiana 'Black Devil'	Pansy	Black	6	8	B	5	5	5
Viola wittrockiana 'Color Festival'	Pansy	Mix	8	8	B	5	5	5
Viola wittrockiana 'Giant Mix'	Pansy	Mix	8	8	B	5	5	5
Viola wittrockiana 'Joker Light Blue'	Pansy	Blue	8	6	B	5	5	5
Viola wittrockiana 'Jolly Joker'	Pansy	Org/Purp	8	6	B	5	5	5
Viola wittrockiana 'Masterpiece'	Pansy	Mix	8	6	B	5	5	5
Viola wittrockiana 'Rococo'	Pansy	Mix	7	5	B	5	5	5
Xeranthemum annuum	Immortelle	Wt/Lil	24	14	B,C,D	9	5	7
Zinnia angustifolia 'Orange Star'	Classic Zinnia	Orange	10	12	B,C	9	5	7
Zinnia elegans 'Canary Yellow'	Zinnia	Yellow	12	10	B,C	8	5	7
Zinnia elegans 'Chippendale Mahogany'	Zinnia	Mahogny	14	10	B,C	8	5	7
Zinnia elegans 'Envy'	Zinnia	Green	18	12	B,C	8	5	7
Zinnia elegans 'Peppermint'	Zinnia	Striped	22	10	B,C	8	5	7
Zinnia elegans 'Ruffled Pink'	Zinnia	Pink	26	18	B,C	8	5	7
Zinnia elegans 'Scabiosiflora'	Zinna Scabiosa Flw	Mix	15	10	B,C	8	5	7
Zinnia elegans 'Sombrero'	Zinnia	Yel/Red	15	10	B,C	8	5	7
Zinnia elegans 'Splendor Hybrid'	Zinnia	Red	22	18	B,C	8	5	7
Zinnia elegans 'Swirls'	Zinnia	Striped	24	12	B,C	8	5	7
Zinnia haageana 'Old Mexico'	Zinnia, Double	Yel/Rd	18	12	B,C	8	5	7

Table 2, Berry Basket.

Ken Roberts, Chairman

Strawberry (*Fragaria* sp.) 'Fort Laramie' is an everbearing variety particularly suited to the cold winters of the Rocky Mountain region. Plant 12 to 18 inches apart in well prepared soil. Mulch well to control weeds and retain moisture.

Table 2. Berry Basket, continued...

Raspberry (*Rubus idaeus*) 'Heritage','Fall Gold' are red raspberries that are productive and ever-bearing. An early summer crop appears on last years canes and a mid-summer-to-frost crop on this years canes. Plant in well prepared, fertile soil about 18 inches apart, 3 to 5 feet between rows. In early spring clear out weeds, loosen soil and dress with well rotted manure.

Gooseberry (*Ribes hirtellum*) These productive, decorative plants are a good choice for high altitudes. 'Pixwell' is a popular, tart variety enjoyed for pies, jellies and jams. 'Leppa Red,' 'Sylvia,' and others produce a larger, sweeter berry excellent for fruit bowls or just eating out of hand. Gooseberries like full sun but will tolerate partial shade.

Currant (*Ribes* sp.)'Red Lake' is a standard in many Denver gardens. It is very productive, with a sweet-tart taste and it is great for cooking, making wine or attracting birds.

Blackberry (*Rubus* sp.) The thornless variety 'Chester' is great for eating fresh or for cooking. It is hardy in Denver but not in the mountains. Blackberries like fertile, somewhat acidic soil, with a pH 5.5, so add plenty of peat moss when planting.

Grapes (*Vitis vinifera*) Always a favorite, grapes are easy to grow and are very tolerant of poor soil, but require good drainage. They are easily trained to arbor or fence. Enrich the soil with organic matter when planting. Prune back hard each spring to enhance production.

Apple (*Malus* sp.) These hardy trees are the descendents of the fruit of early settlers. There are in excess of 5000 varieties of apple, many still maintained by aficionados. Available as dwarf (8-10 feet), semi-dwarf (12-15 feet) and standard (18-25 feet) trees. Plant in full sun. Mix plenty of peat moss in the soil. While most apples are self fertile, two or more varieties will improve fertilization.

Cherry (*Prunus* sp.) Very popular in Denver, cherries are one of the earliest trees to bloom in the spring. 'Montmorency', growing approx. 15 feet tall, is the standard for pie cherries. 'North Star' is a dwarf variety growing to about 10 feet when mature. The sour cherries are self-fertile, however, the sweet cherries such as 'Bing' or 'Black Tartarian' required cross pollination.

Plum (*Prunus* sp.) Plums are very desirable for small properties, rarely grow over 12-15 feet. With proper pruning they can easily be maintained between 8 and 10 feet. The European varieties will grow well in heavy soils whereas the Japanese varieties prefer a light, loamy soil.

Peach (*Prunus persica*) One of Colorado's favorite fruits, the peach generally does quite well in our winters. However, because it blooms relatively early there is always the danger of loosing the crop to a late frost or snow storm. Peaches are also susceptible to rot and borers so they require a bit more vigilance than fruits such as apples.

Apricot (*Prunus armeniaca*) Apricots are an "iffy" tree in the Denver area but are quite reliable in the inner city where there is more protection. The apricot is the earliest fruit tree to bloom and generally gets nipped by a frost. If you have the right location, in a protected spot on the north side where it will stay dormant longer, it can be a very rewarding addition to your garden.

Pear (*Pyrus communis*) Pears tend to be the tallest of the fruit trees with an upright growing habit that requires forced spreading of the branches. They are hardy in the Denver area but may not do well at the higher elevations. They produce an abundance of succulent growth therefore must be pruned heavily. Plant two varieties to assure pollination.

Table 3, Herbs.

Barbara Moore, Chairman

[B = month of beginning bloom; F = month of final bloom; **HT**(Height); S(Sun): 1 = full shade, 9 = full sun; **SL**(Soil): 1 = acid peat, 9 = alkaline clay; **W**(Water): 1 = wet, 9 = dry; **C**: P = perennial, A = annual, B = biennial; **H**: H = hardy, T = tender, F = half hardy]

COMMON NAME	LATIN NAME	B	F	HT	S	SL	W	C	H
Aloe	*Aloe barbadensis*	--	--	12-24"	5	5	8	P	T
Angelica	*Angelica archangelica*	7	8	5-6'	7	5	4	B	H
Anise	*Pimpinella anisum*	7	8	18-24"	9	5	8	A	T
Arugula	*Eruca vesicaria sativa*	--	--	18"	9	5	6	A	T
Basil, cinnamon	*Ocimum basilicum* 'Globe'	8	8	2'	9	5	4	A	T
Basil, globe, spicy	*Ocimum basilicum* 'Spicy Globe'	8	8	2'	9	5	4	A	T
Basil, Green Ruffles	*Ocimum basilicum* 'Green Ruffles'	8	8	2'	9	5	4	A	T
Basil, lemon	*Ocimum basilicum* 'Lemon'	8	8	2'	9	5	4	A	T
Basil, licorice	*Ocimum basilicum* 'Licorice'	8	8	2'	9	5	4	A	T
Basil, opal	*Ocimum basilicum* 'Dark Opal'	8	8	2'	9	5	4	A	T

Table 3. Herbs, continued...

COMMON NAME	LATIN NAME	B	F	HT	S	SL	W	C	H
Basil, Holy	*Ocimum basilicum* 'Sanctum'	8	8	2'	9	5	4	A	T
Basil, Piccolo	*Ocimum basilicum* 'Piccolo'	8	8	2'	9	5	4	A	T
Basil, Purple Ruffles	*Ocimum basilicum* 'Purple Ruffles'	8	8	2'	9	5	4	A	T
Basil, Sweet Green	*Ocimum basilicum* 'Sweet Green'	8	8	2'	9	5	4	A	T
Bay	*Laurus nobilis*	--	--	10'	5	5	3	P	T
Bee Balm	*Monarda didyma*	7	8	3'	7	5	3	P	H
Bergamont	*Monarda fistulosa*	--	--	3'	--	--	--	P	--
Borage	*Borago officinalis*	7	9	12-18"	9	5	4	A	H
Burnet, Salad	*Sanguisorba minor*	6	9	12"	9	5	7	P	H
Calendula	*Calendula officinalis*	6	9	12"	9	5	6	A	H
Caraway	*Carum carvi*	6	7	2'	8	5	7	B	H
Catnip	*Nepeta cataria*	7	9	3'	8	5	6	P	H
Celeriac	*Apium gravenolens*	--	--	1'	--	--	--	A	--
Chamomile (German)	*Matricaria recutita*	6	6	2'	9	5	4	A	H
Chamomile (Roman)	*Anthemis nobilis*	6	9	4-12"	7	5	4	P	H
Chervil	*Anthriscus cerefolium*	--	--	1-2'	5	5	4	A	T
Chicory	*Cichorium intybus*	7	9	3-6'	9	5	5	P	H
Chives	*Allium schoenoprasum* 'Grolau'	6	9	1'	8	5	4	P	H
Chives, Garlic	*Allium tuberosum*	6	9	12"	8	5	4	P	H
Cicely, Sweet	*Myrrhis odorata*	6	6	2-3'	5	5	3	P	H
Comfrey	*Symphytum officinale*	6	9	2-3'	5	5	3	P	H
Coriander	*Coriandrum sativum*	7	7	2-3'	9	5	6	A	H
Costmary	*Chrysanthemum balsamita*	7	7	2'	6	5	8	P	H
Cress, Garden, Pepper Cress	*Lepidium sativum*	--	--	18"	5	5	6	A	H
Cress, Uplant, Winter Cress	*Barbare vulgaris*	5	9	18"	6	5	4	P	H
Cumin	*Cuminum cyminum*	7	7	6-8"	9	5	5	A	H
Dill	*Anethum graveolens*	7	9	3'	9	5	5	A	H
Epasote	*Chenopodium ambrosioides*	7	9	3-4'	5	5	5	P	H
Fennel	*Foeniculum vulgare*	--	--	4'	9	5	5	A	H
Garlic, Society	*Tulbaghia violacea*	--	--	12-18"	9	5	5	P	H
Germander	*Teucrium chamaedrys*	7	9	6-18"	9	5	3	P	H
Heliotrope	*Heliotropium peruvianum*	6	9	6-12"	7	5	5	A	T
Horehound	*Marrubium vulgare*	6	9	2'	8	5	8	P	H
Hyssop	*Hyssopus officinalis*	7	8	2'	9	5	5	P	H
Joseph's Coat	*Amaranthus tricolor*	7	7	5'	9	5	5	A	T
Lady's Mantle	*Alchemilla vulgaris*	7	8	16"	8	5	7	P	H
Lamb's ear	*Stachys byzantina*	7	7	12-18"	9	5	5	P	T
Lavender, English	*Lavandula angustifolia*	7	8	18"	9	5	5	P	H
Lavender, French	*Lavandula dentata*	7	8	1-3'	9	5	5	P	H
Lavender, Munstead	*Lavandula dentata* 'Munstead'	7	8	18"	9	5	5	P	H
Lemon Balm	*Melissa officinalis*	7	9	2-3'	5	5	5	P	H
Lemon Grass	*Cymbopogon citratus*	--	--	4'	9	5	5	P	T
Lemon Verbena	*Aloysia triphylla*	8	9	2'	5	5	5	P	T
Lion's Ear	*Leonotis leonurus*	8	9	--	9	5	5	P	H
Lovage	*Levisticum officinale*	8	9	4-6'	6	5	4	P	H
Marjoram, Creeping golden	*Origanum vulgare* 'Aureum'	--	--	4-6"	9	5	5	P	H
Marjoram, sweet	*Origanum majorana*	8	9	12"	9	5	5	A	T
Mint, Apple	*Mentha suaveolens*	--	--	18"	5	5	4	P	H
Mint, Corsican	*Mentha requienii*	--	--	1"	3	5	3	P	H
Mint, Curly	*Mentha crispa* var.	--	--	--	12	8	4	P	H
Mint, Lemon	*Monarda citriodora*	--	--	4-6"	8	5	4	P	H

Table 3. Herbs, continued...

COMMON NAME	LATIN NAME	B	F	HT	S	SL	W	C	H
Mint, orange	*Mentha piperita citrata*	--	--	1-2'	8	5	4	P	H
Mint, Peppermint	*Mentha piperata*	--	--	12"	8	5	4	P	H
Mint, Pineapple	*Mentha suaveolens variegata*	--	--	10"	8	5	4	P	H
Mint, Spearmint	*Mentha spicata*	--	--	2'	8	5	4	P	H
Oregano, Greek	*Origanum vulgare* 'Greek'	--	--	12-20"	8	5	5	P	H
Parsley, Curly	*Petroselinum crispum*	7	8	12"	8	5	4	B	H
Parsley, Italian	*Petroselinum crispum* 'Neopolitanum'	7	8	12"	8	5	4	B	H
Pennyroyal, English	*Mentha pulegium*	--	--	3"	5	5	3	P	T
Perilla, Green	*Perilla frutescens* var.	--	--	2-4'	8	5	5	A	T
Perilla, Red	*Perilla frutescens*	--	--	2-4'	8	5	5	A	T
Pimpernel, Scarlet	*Anagallis arvensis*	--	--	6"	9	5	5	P	T
Rosemary	*Rosmarinus officinalis*	--	--	2-3'	9	5	5	P	T
Rosemary, Blue	*Rosmarinus officinalis* 'Tuscan Blue'	--	--	2-3'	9	5	5	P	T
Rosemary, Pink	*Rosmarinus officinalis*	--	--	2-3'	9	5	5	P	T
Rue, Herb-of-Grace	*Ruta graveolens*	7	8	2-3'	8	5	5	P	H
Sage, Garden	*Salvia officinalis*	7	8	2'	9	5	5	P	H
Sage, Pineapple	*Salvia elegans*	9	9	3'	8	5	5	P	T
Sage, Tri-color	*Salvia officinalis* 'Tri-color'	7	8	2'	9	5	5	P	H
Santolina, Lavender cotton	*Santolina chamaecyparissus*	--	--	2'	9	5	7	P	H
Savory, Summer	*Satureja hortensis*	7	7	18"	8	5	4	A	T
Savory, Winter	*Satureja montana*	6	7	12"	5	5	5	P	H
Sorrel, French	*Rumex acetosa*	--	--	2'	8	5	4	P	H
Southernwood	*Artemisia abrotanum*	--	--	2-3'	5	5	5	P	H
Sweet Woodruff	*Galium odoratum*	6	6	6"	3	5	3	P	H
Tansy	*Tanacetum vulgare*	9	--	3'	9	5	5	P	H
Tarragon, French	*Artemisia dracunculus*	--	--	2'	8	5	5	P	H
Thyme, Caraway	*Thymus herba-barona*	7	8	6-8"	9	5	5	P	H
Thyme, Creeping Lemon	*Thymus* x *citriodorus*	--	--	3-6"	8	5	7	P	H
Thyme, English	*Thymus vulgaris*	--	--	6-8"	9	5	7	P	H
Thyme, Mother-of-Thyme	*Thymus pracox* 'Coccineum'	--	--	3-6"	9	5	7	P	H
Thyme, Silver	*Thymus vulgaris* 'Argenteus'	--	--	6-12"	9	5	7	P	H
Thyme, Wooly	*Thymus psuedolanuginosus*	--	--	2"	9	5	7	P	H
Valerian	*Valeriana officinalis*	7	8	3'	8	5	5	P	H
Watercress	*Nasturtium officinale*	--	--	3"	5	5	3	P	H
Wormwood, Absinthe	*Artemisia absinthium*	--	--	2'	8	5	8	P	H

Table 4, Perennials.
John Reber, Chairman

[B: month of first bloom; F: month of final bloom; HT: hight in inches; SP: spread in inches; S (sun): 1=full shade, 9=full sun; Sl (soil): 1=alkaline clay, 9=acid peat; WT (water): 1=wet, 9=dry]

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	Sl	WT
Achillea filipendulina 'Coronation Gold'	Yarrow	Gold	6	9	36	24	8	5	6
Achillea filipendulina 'Moonshine'	Yarrow	Yellow	6	9	22	20	8	5	6
Achillea millefolium 'Red Beauty'	Yarrow	Red	7	10	24	24	8	5	7
Achillea ptarmica 'The Pearl'	Yarrow	White	6	9	24	24	8	5	6
Aconitum anthora	Monkshood	Yellow	6	7	30	12	4	5	5
Aconitum x *bicolor*	Bicolor Monkshood	Bl/Wh	7	8	40	15	5	4	5
Aconitum napellus	Monkshood	Purple	7	8	48	18	4	5	5
Aegopodium podagraria variegatum	Bishop's Weed	White	6	7	10	36	3	5	5

Table 4. Perennials, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	SI	WT
Alchemilla vulgaris	Lady's Mantle	Charturse	5	6	18	15	5	5	5
Allium cernuum	Nodding Onion	Rose	7	8	15	6	7	6	5
Amorpha canescens	Leadplant	Purple	7	8	48	24	9	7	8
Anchusa azurea 'Regal'	Bugloss	Blue	5	6	48	24	8	5	5
Anchusa azurea 'Royal Blue'	Bugloss	Blue	5	6	48	24	8	5	5
Andropogon scoparius	Little Bluestem Grass	Grass	8	10	48	24	8	5	7
Anemone sylvestris	Windflower	White	4	5	15	10	5	4	4
Anemone vitifolia `Robustissima'	Grape-Leaved Anemone	Pink	8	10	48	24	4	5	4
Anemone x hybrida 'Honorine Jobert'	Japanese Anemone	White	8	10	60	24	5	4	4
Anemone x hybrida 'Prinz Heinrich'	Japanese Anemone	Rose	8	10	24	16	5	4	4
Anthemis biebersteiniana	Filigree Daisy	White	5	8	12	12	9	6	7
Aquilegia caerulea	Rocky Mountain Columbine	Blue	5	7	15	12	5	5	5
Aquilegia canadensis	American Columbine	Rd/Yel	5	6	18	12	4	4	4
Aquilegia elegantula	Columbine	Rd/Yel	6	7	8	8	4	5	6
Aquilegia saximontana	Dwarf Columbine	Blue	5	7	8	6	4	5	5
Aquilegia x 'Blue Bird'	Columbine	Blue	5	7	18	12	4	5	5
Aquilegia x 'Cardinal'	Columbine	Red	5	7	18	12	4	5	5
Aquilegia x 'Crimson Star'	Columbine	Red	5	7	18	12	4	5	5
Aquilegia x 'McKana Hybrids'	Mckana Hybrid Columbine	Mix	5	7	18	12	4	5	5
Armeria maritima 'Splendens'	Sea Pink	Pink	5	7	8	8	8	5	6
Armeria maritima 'Dusselford Pride'	Sea Pink	Red	6	7	10	10	8	5	6
Artemisia schmidtiana	Silver Mound Sage	Silver	--	--	10	12	8	5	6
Aruncus diocus 'Kneiffii'	Goat's Beard	Cream	6	7	36	18	4	3	4
Asclepias tuberosa	Butterfly Weed	Orange	7	10	18	12	8	6	8
Aster alpina	Alpine Aster	Mix	5	7	10	10	7	5	5
Aster novae-angliae	New England Aster	Lavender	8	10	48	24	7	5	5
Aster x *frikartii*	Wonder Of Staffa Aster	Lavender	7	10	30	18	8	5	6
Aster x 'Fall-Tall'	Aster	Mixed	8	10	48	24	7	5	5
Astilbe taquetii	False Spirea	Lavender	8	9	48	30	5	4	4
Astilbe x *arendsii* 'Deutchland'	False Spirea	White	6	7	20	26	4	4	3
Astilbe x 'Fanal'	False Spirea	Red	6	7	20	26	4	4	3
Astilbe x 'Rheinland'	False Spirea	Pink	6	7	20	26	4	4	3
Athyrium filix-femina	Lady Fern	--	--	--	30	15	2	4	3
Aubrietia deltoidea	Rock Cress	Magenta	5	6	6	15	7	5	6
Aurinia saxatil	Basket Of Gold	Yellow	4	5	12	24	9	5	7
Avena sempervirens	Blue Avena Grass	Grass	8	9	30	24	8	5	6
Baptisia australis	Wild Indigo	Indigo	6	8	36	20	8	4	4
Belamcanda chinensis	Blackberry Lily	Orange	7	8	24	12	7	5	5
Bergenia cordifolia	Leatherleaf	Pink	4	5	12	18	5	5	5
Bergenia cordifolia 'Silver Light'	Leatherleaf	White	4	5	12	18	5	5	5
Bergenia cordifolia 'Perfect'	Leatherleaf	Plum	4	5	18	18	5	5	5
Bergenia purpurencens	Leatherleaf	Dk. Lilac	4	5	16	18	5	5	5
Bouteloua curtipendula	Blue Grama Grass	Grass	7	9	24	10	8	5	6
Brunnera macrophylla	Siberian Bugloss	Blue	4	6	15	12	4	4	4
Campanula persicifolia	Peach-leaf Bellflower	Blue	6	9	30	12	7	5	5
Campanula rotundifolia	Native Harebell	Blue	6	9	12	10	7	5	5
Catananche coerulea	Cupid's Dart	Blue	6	9	18	12	9	6	7
Centaurea dealbata	Rose Cornflower	Pink	6	7	20	20	8	5	6
Centaurea montana	Perennial Bachelor Button	Blue	6	7	24	24	8	6	7
Centranthus ruber	Jupiter's Beard	Coral	6	8	30	15	8	5	5
Chelone obliqua	Turtle Head	Pink	7	8	36	20	4	6	4

Table 4. Perennials, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	SI	WT
Chrysanthemum leucanthemum	Ox-Eye Daisy	White	6	8	20	15	8	6	6
Chrysanthemum maximum 'Alaska'	Shasta Daisy	White	6	8	24	24	8	6	6
Chrysanthemum maximum 'Silver Princess'	Shasta Daisy	White	6	8	12	12	8	6	6
Chrysanthemum maximum 'Marconi'	Double Shasta Daisy	White	6	8	24	24	8	6	6
Chrysanthemum maximum 'Miss Muffet'	Dwarf Shasta Daisy	White	6	8	10	15	8	6	6
Chrysanthemum x *morifolium*	Hardy Fall Mums	Assort.	8	11	24	24	8	5	5
Cimicifuga simplex 'Autopurpurea'	Ivory Spires	White	9	10	36	18	4	4	4
Clematis orientalis	Clematis	Yellow	6	7	Vn	--	8	6	6
Clematis x *jackmanii*	Clematis 'Jackman's'	Purple	6	8	Vn	--	6	5	5
Clematis x 'Mme Andre'	Clematis	Pink	6	7	Vn	--	6	5	5
Clematis x 'Ramona'	Clematis	Blue	6	7	Vn	--	6	5	5
Clematis x 'Lanuginosa Candida'	Clematis	White	6	7	Vn	--	6	5	5
Coreopsis grandiflora 'Gold Fink'	Double Dwarf Coreopsis	Yellow	6	8	10	12	8	5	6
Coreopsis grandiflora 'Baby Sun'	Double Dwarf Coreopsis	Yellow	6	8	10	12	8	5	6
Coreopsis grandiflora 'Early Sunrise'	Double Dwarf Coreopsis	Yellow	6	8	10	12	8	5	6
Coreopsis lanceolata	Lance-leaf Coreopsis	Yellow	6	8	18	18	8	5	6
Coreopsis verticillata 'Moonbeam'	Thread-leaf Coreopsis	Yellow	5	10	10	15	7	5	5
Coropsis verticillata 'Zargreb'	Thread-leaf Coreopsis	Yellow	6	10	15	15	7	5	5
Delosperma cooperi	Hardy Iceplant	Magenta	6	10	4	15	9	5	8
Delosperma nubigenum	Hardy Iceplant	Yellow	6	9	2	15	8	5	8
Delphinium x	Delphinium	Mixed	6	7	60	24	8	5	5
Delphinium x 'Connecticut Yankee'	Delphinium	Mixed	6	7	36	28	8	5	5
Dianthus caryophyllus	Carnation	Mixed	6	8	15	12	9	5	6
Dicentra eximia 'Luxuriant'	Fringed Bleeding Heart	Pink	5	10	12	12	4	4	4
Dicentra spectabilis	Bleeding Heart	Pink	5	6	24	24	3	4	4
Dicentra spectabilis 'Alba'	Bleeding Heart	White	5	6	24	24	3	4	4
Digitalis ambigua	Foxglove	Yellow	6	8	30	12	5	5	4
Dryopteris marginalis	Leatherwood Fern	--	--	--	30	24	2	3	3
Echinacea pallida	Pale Coneflower	Lavender	7	10	36	18	8	6	5
Echinacea purpurea	Purple Coneflower	Wine Pk	7	10	36	24	8	6	6
Echinops ritro	Globe Thistle	Blue	7	8	36	18	8	5	6
Epilobium angustifolium	Fireweed	Dp Pink	7	8	36	24	6	6	7
Erigeron compositus	Whiplash Daisy	White	4	10	4	6	8	7	8
Euphorbia polychroma	Cushion Spurge	Yellow	5	6	15	15	5	5	5
Festuca ovina glauca	Blue Fescue Grass	Grass	5	9	12	10	8	7	6
Filipendula hexapetalla	Meadow Sweet	Cream	6	7	18	15	7	6	5
Filipendula purpurea	Meadow Sweet	Carminer	6	7	36	15	7	6	5
Gaillardia aristata	Indian Blanket	Rd/Yel	6	10	24	18	9	6	8
Gaillardia x *grandiflora* 'Baby Cole'	Indian Blanket	Rd/Yel	6	10	10	12	9	6	8
Gaillardia x *grandiflora* 'Burgundy'	Indian Blanket	Burgundy	6	10	24	18	9	6	8
Gaillardia x *grandiflora* 'Goblin'	Dwarf Indian Blanket	Rd/Yel	6	10	15	12	9	6	8
Geranium endressii 'Wargrave Pink'	Pyrenean Cranesbill	Pink	6	8	15	24	6	5	5
Geranium macrorrhizum 'Ingwersen Variety'	Cranesbill	Rose	5	7	12	24	5	5	5
Geranium psilostemon	Armenian Cranesbill	Magenta	5	8	30	20	5	5	5
Geranium sanguineum 'Album'	Bloody Cranesbill	White	5	8	10	24	5	5	5
Geranium x 'Claridge Druce'	Cranesbill	Purple	5	8	24	24	5	5	5
Geum guellyon 'Mrs. Bradshaw'	Geum	Red	6	8	15	12	6	5	5
Geum quellyon 'Lady Stratheden'	Geum	Yellow	6	8	15	12	6	5	5
Geum triflorum	Prairie Smoke	Pink	5	7	10	8	5	5	5
Geum x *borisii*	Geum	Scarlet	5	7	12	12	6	5	5
Goniolimon tartaricum	German Statice	White	6	7	10	12	9	6	6

Table 4. Perennials, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	SI	WT
Gypsophila paniculata	Baby's Breath	White	6	8	36	36	8	5	6
Gypsophila paniculata 'Bristol Fairy'	Double Baby's Breath	White	6	8	36	36	8	5	6
Gypsophila paniculata 'Pink Fairy'	Double Baby's Breath	Pink	6	8	36	36	8	5	6
Gypsophila repens	Creeping Baby's Breath	White	5	8	6	24	9	5	7
Helenium autumnale	Sneeze Weed	Yel/Org	8	10	40	24	8	5	5
Helianthemum nummularium	Sunrose	Assort.	5	7	10	18	8	5	7
Heliopsis helianthoides 'Summer Sun'	False Sunflower	Yellow	7	10	40	18	9	5	7
Hemerocallis middendorffi	Daylily	Yl/Org	5	6	28	20	8	5	6
Hemerocallis x 'Baha'	Daylily	Ruby	6	7	30	24	8	5	6
Hemerocallis x 'Canary Glow' (tetraploid)	Daylily	Yellow	6	7	30	24	8	5	6
Hemerocallis x 'Channel Islands'	Daylily	Yellow	7	8	24	24	8	5	6
Hemerocallis x 'Crimson Pirate'	Daylily	Rd/Yel	6	7	24	24	8	5	6
Hemerocallis x 'Elaine Strutt' (tetraploid)	Daylily	Pink	6	7	30	24	8	5	6
Hemerocallis x 'Frans Hals'	Daylily	Orange	6	8	30	24	8	5	6
Hemerocallis x 'Halls Pink'	Daylily	Pink	7	8	20	24	8	5	6
Hemerocallis x 'Tawny'	Daylily	Buff	5	7	38	24	8	5	6
Heuchera micrantha 'Palace Purple'	Purple-Leaf Coral Bells	White	6	7	24	16	5	5	5
Heuchera sanguinea	Coral Bells	Coral	6	8	12	12	5	5	6
Heuchera sanguinea alba	Coral Bells	White	6	8	12	12	5	5	6
Hibiscus moscheutos	Hardy Hibiscus	Rd; Wt	7	9	40	18	7	5	4
Hosta fortunei 'Aoki'	Hosta	Lavender	7	8	18	18	3	4	3
Hosta capitata	Heart-Shaped Hosta	Lavender	7	8	10	18	3	4	3
Hosta lancifolia	Lance-Leaf Hosta	Lavender	8	9	18	15	3	4	3
Hosta sieboldiana 'Elegans'	Blue Giant Hosta	Lavender	7	8	30	24	3	4	3
Hosta sieboldiana 'Frances Williams'	Blue Giant Hosta	Lavender	7	8	30	24	3	4	3
Hosta undulata 'Albo Marginata'	White-Edged Hosta	Lavender	7	8	20	20	3	4	3
Hosta undulata 'Erromena'	Hosta	Lavender	7	8	30	30	3	4	3
Hosta ventricosa 'Aurea Marginata'	Hosta	Lavender	7	8	30	30	3	4	3
Hosta x *tardiana* 'Blue Wedgewood'	Blue Edger Hosta	Lavender	7	8	10	24	3	4	3
Hosta x *tardiana* 'Hadspen Blue'	Blue Hosta	Lavender	7	8	24	24	3	4	3
Hosta x 'Francee'	Hosta	Lavender	7	8	24	24	3	4	3
Hosta x 'Honeybells'	Light Green Hosta	Lavender	8	9	30	24	3	4	3
Hosta x 'Royal Standard'	Hosta	Lavender	7	8	36	24	3	4	3
Hosta x 'Zounds'	Hosta	Lavender	7	8	28	24	3	4	3
Iberis sempervirens	Evergreen Candytuft	White	4	5	8	18	6	6	5
Imperata cylinrica 'Rubra'	Japanese Blood Grass	Grass	--	--	18	12	8	5	5
Iris enstata 'Activity'	Japanese Iris	Lt. Blue	6	7	32	18	7	1	3
Iris enstata 'Emotion'	Japanese Iris	Wt/Blue	6	7	32	18	7	1	3
Iris enstata 'Innocence'	Japanese Iris	White	6	7	30	18	7	1	3
Iris enstata 'Iso-no-nami'	Japanese Iris	Lt.Purple	6	7	32	18	7	1	3
Iris enstata 'Velvety Queen'	Japanese Iris	Dp. Blue	6	7	32	18	7	1	3
Iris missouriensis	Blue Flag Iris	Blue	5	6	12	15	6	4	5
Iris palada	Zebra Iris	Lavender	5	6	24	15	7	5	6
Iris siberica	Siberian Iris	Purple	5	6	36	30	7	5	5
Iris siberica 'Fourfold White'	Iris, Siberian	White	6	7	36	30	7	5	5
Iris x *germanica*	German Bearded Iris Hybrids	Assort.	5	6	24	18	7	5	6
Kasmanthia spp.	Northern Sea Oats	Grass	9	10	24	28	5	5	5
Kniphofia uvaria	Red Hot Poker	Orange	7	8	24	15	9	5	6
Kniphofia uvaria 'Primrose Beauty	Torch Lily	Yellow	7	10	40	24	9	5	6
Kniphofia uvaria 'Pfitzer's Hybrid'	Red Hot Poker	Orange	7	8	24	15	9	5	6
Lavandula angustifolia	English Lavender	Lavender	7	8	15	12	8	5	6

Table 4. Perennials, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	SI	WT
Liatris punctata	Dwarf Gayfeather	Purple	8	9	12	10	9	6	8
Liatris pycnostachya	Cat-Tail Gayfeather	Purple	7	9	36	12	9	6	7
Liatris spicata	Spiked Gayfeather	Purple	7	9	24	12	8	5	7
Ligularia przewalskii 'The Rocket'	Ligularia	Yellow	7	8	60	30	6	4	3
Limonium latifolium	Wide-Leaved Sea Lavender	Purple	7	8	18	12	8	5	7
Linum flavum	Yellow Flax	Yellow	6	7	10	12	9	6	6
Linum perenne	Wild Blue Flax	Blue	5	8	24	18	8	6	7
Lonicera japonica 'Halliana'	Honeysuckle, Hall's	Cream	6	8	Vn	--	5	5	5
Lunaria annua	Moneyplant, Silver Dollar	Prp; Wht	6	7	36	12	5	5	5
Lupinus x polyphyllus 'Chandelier'	Lupine	Yellow	6	7	30	24	6	5	5
Lupinus x polyphyllus 'Governor'	Lupine	Blue	6	7	30	24	6	5	5
Lupinus x polyphyllus 'Nobel Maiden'	Lupine	White	6	7	30	24	6	5	5
Lupinus x polyphyllus 'Popsicle'	Lupine	Assort.	6	7	24	20	6	5	5
Lupinus x polyphyllus 'Russel Hybrids'	Lupine	Assort.	6	7	30	24	6	5	5
Lupinus x polyphyllus 'Red Flame'	Lupine	Red	6	7	30	24	6	5	5
Lychnis chalcedonica	Maltese Cross	Scarlet	6	7	36	15	8	5	6
Lychnis viscaria 'Splendens'	German Catchfly	Red	6	7	36	15	8	5	6
Lythrum salicaria	Loosestrife	Magenta	7	8	48	24	6	4	4
Macleaya cordata	Plume Poppy	Cream	7	8	7'	24	6	5	5
Matteuccia pennsylvanica	Ostrich Fern	--	--	--	40	30	3	4	4
Miscanthus sinensis var. *gracillimus*	Miscanthus Grass	Grass	8	9	60	24	8	5	5
Miscanthus sinensis var. *zebrinus*	Zebra Grass	Grass	8	9	60	24	8	5	5
Molinia caerulea 'Variegata'	Variegated Moor Grass	Grass	8	9	36	20	7	5	5
Monarda didyma 'Cambridge Scarlet'	Bee Balm	Red	6	8	24	24	7	7	5
Monarda fistulosa menthifolia	Native Bee Balm	Lavender	6	8	24	24	7	7	5
Oenothera missourensis	Missouri Evening Primrose	Yellow	6	8	12	16	9	5	7
Oxytropis lambertii	Lambert's Loco Weed	Magenta	5	7	6	18	8	6	8
Paeonia lactiflora (varieties)	Peony	Assort.	6	7	30	24	7	5	5
Paeonia suffruticosa	Tree Peony	Assort.	5	6	48	48	5	4	4
Paeonia tenufolia rubra plena	Fern Leaf Peony	Red	5	6	20	24	7	4	4
Papaver nudicaule	Iceland Poppy	Mix	6	9	14	10	9	5	5
Papaver orientale `Salmon'	Oriental Poppy	Pink	6	6	30	24	8	5	6
Papaver orientale `Allegro'	Dwarf Oriental Poppy	Red	6	6	24	18	8	5	6
Papaver orientale `Goliath'	Oriental Poppy	Scarlet	6	6	40	24	8	5	6
Papaver orientale `Perry's White'	Oriental Poppy	White	6	6	32	24	8	5	6
Papaver orientale `Pinacle'	Oriental Poppy	Red	6	6	28	24	8	5	6
Papaver orientale `Prince of Orange'	Oriental Poppy								
Papaver orientale `Princess V. Louise'	Oriental Poppy								
Pardanthopsis dichotoma	Vesper Iris	Lavender	7	9	36	15	8	5	6
Peltiphyllum peltatum	Umbrella Plant	Rose	8	9	30				
Penstemon barbatus	Scarlet Bugler Penstemon	Red	6	7	36	15	9	6	7
Penstemon barbatus	Yellow Bugler Penstemon	Yellow	6	7	36	15	9	6	7
Penstemon cardinalis	Cardinal Penstemon	Red	6	7	24	12	9	6	7
Penstemon eatonii	Firecracker Penstemon	Orange	6	7	36	15	9	6	7
Penstemon palmeri	Palmer's Penstemon	Pink	6	7	36	15	9	6	7
Penstemon pinifolius	Pine-Leaf Penstemon	Scarlet	6	8	6	10	9	5	8
Penstemon pseudospectabilis	Rose-Pink Penstemon	Pink	6	7	36	15	9	5	8
Penstemon strictus 'Bandera'	Rocky Mountain Penstemon	Purple	6	8	24	15	9	6	8
Perovskia atriplicifolia	Russian Sage	Purple	7	9	40	24	9	6	8
Phalaris arundinacea 'Picta'	Ribbon Grass	--	--	--	30	30	7	5	5
Phlomis russeliana	Jerusalem Sage	Yellow	6	8	36	15	7	5	5

Table 4. Perennials, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	Sl	WT
Phlox maculata 'Alpha'	Garden Phlox	Rose	6	8	32	12	7	5	5
Phlox maculata 'Delta'	Garden Phlox	Wht/Rd	6	8	32	12	7	5	5
Phlox maculata 'Rosalinde'	Garden Phlox	Rose	6	8	32	12	7	5	5
Phlox paniculata	Tall Garden Phlox	Assort.	6	8	36	15	7	5	5
Phlox subulata	Creeping Phlox	Assort.	5	6	4	15	8	5	6
Physostegia virginiana	Obedient Plant	Pk; Wt	8	9	30	20	6	5	5
Platycodon grandiflorum	Balloon Flower	Pk;Bl;Wt	7	9	24	15	6	5	5
Polemonium caeruleum	Jacob's Ladder	Blue	5	7	24	15	6	5	5
Polygonum affine	Himalayan Border Jewel	Pink	8	10	8	24	7	5	6
Polygonum aubertii	Silver Lace Vine	White	8	10	Vn	--	7	5	6
Potentilla nepalensis 'Miss Willmott'	Potentilla	Rose	6	8	14	24	8	5	6
Potentilla verna nana	Potentilla,Cinquefoil	Yellow	4	6	4	6	8	5	6
Primula denticulata	Himalayan Primrose	Lavender	3	5	10	8	5	5	5
Pulmonaria saccarata 'Mrs. Moon'	Soldiers and Sailors	Pink	4	5	12	12	3	5	4
Pycnanthemum virginianum	Mountain Mint	Wht/Grn	7	8	24	12	7	5	6
Ratibida pinnata	Tall Yellow Coneflower	Yellow	8	9	30	18	9	6	7
Rudbeckia fulgida 'Goldsturm'	Black-Eyed Susan	Gold	7	10	30	24	8	5	6
Rudbeckia hirta	Gloriosa Daisy	Assort.	6	10	30	18	8	5	6
Salvia nemorosa 'Superba'	Purple Sage	Purple	6	7	26	16	8	5	5
Santolina chamaecyparissus	Lavender Cotton	Yellow	7	8	15	12	9	5	6
Scabiosa caucasica	Pincushion Flower	Blue	6	7	18	15	8	5	6
Sedum spectabile `Ruby Glow'	Stonecrop, Showy	Pink	8	9	12	8	9	5	6
Salidago canadensis	Canadian Goldenrod	Yellow	7	9	48	24	8	5	7
Solidago decumbens	Goldenrod, Dwarf	Yellow	7	8	12	10	9	5	7
Solidago rigida	Goldenrod, Stiff	Yellow	8	10	36	24	9	5	8
Stachys byzantina	Lamb's Ears	Silver	--	--	8	18	5	6	6
Stokesia laevis 'Blue Danube'	Stoke's Aster	Blue	7	10	16	12	8	6	5
Thermopsis divaricarpa	Golden Banner	Yellow	4	6	18	12	8	4	5
Thalictrum aquilegiafolium	Meadow Rue	Pink	5	6	48	24	5	5	5
Thalictrum dalavayi	Meadow Rue	Lavender	7	8	60	24	5	4	4
Thermopsis montana	Golden Banner	Yellow	4	6	24	18	8	4	5
Tiarella wherryi	Foamflower	Blush	4	5	12	10	4	4	4
Tradescantia virginiana	Spiderwort	Purple	5	7	18	18	6	5	5
Tradescantia x *andersoniana* 'Pauline'	Spiderwort	Orchid	5	7	18	18	6	5	5
Tradescantia x *andersoniana* 'Red Cloud'	Spiderwort	Magenta	5	7	15	15	6	5	5
Tradescantia x *andersoniana* 'Snowcap'	Spiderwort	White	5	7	18	18	6	5	5
Tradescantia x *andersoniana* 'Zwanenburg'	Spiderwort	Blue	5	7	18	18	6	5	5
Trollius europaeus	Globeflower	Yellow	5	6	12	8	3	3	3
Trollius ledebourii 'Golden Queen'	Globeflower	Gold	5	6	30	15	4	4	3
Veronica incana	Silver Speedwell	Blue	6	7	12	10	7	7	7
Veronica spicata	Speedwell	Bl;Pk;Wh	7	8	24	18	8	5	5
Vinca minor	Periwinkle	Blue	5	7	6	24	5	5	5

Table 5, Rock Alpine / Ground Covers.
Lynda Goldstein and Kathy Borgen, Chairmen

[**B**: month of first bloom; **F**: month of final bloom; **HT**: height in inches; **SPD**: spread, in inches; **SN** (sun): 1=full shade, 9=full sun; **SL** (soil): 1=alkaline clay, 9=acid peat; **W** (water): 1=wet, 9=dry]

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Abies balsamea nana	Dwarf Balsam Fir	Green	--	--	12	20	5	5	4
Acantholimon armenum	Armenian Spikethrift	Pink	5	7	6	10	7	7	6

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Achillea ageratifolia	Greek Yarrow	White	5	6	3	14	8	6	6
Achillea serbica	Serbian Yarrow	White	5	7	6	8	8	6	7
Adiantum pedatus var. *subpumilum*	Dwarf Five Finger Fern	Green	--	--	3	8	5	5	4
Aegopodium podagaeia variegatam	Bishop's Weed	Gr/Wht	6	7	15	30	5	5	6
Aethionema 'Warley Rose'	Persian Candytuft	Rose/Pk	5	6	4	12	8	6	6
Aethyrium nipponicum var. *Pitcum*	Japanese Painted Fern	--	--	--	15	12	4	5	4
Ajuga reptans	Bugleweed	Lavender	5	6	4	15	5	6	5
Ajuga reptans 'Burgundy Glow'	Burgundy Ajuga	Lavender	5	6	4	15	5	6	5
Ajuga reptans 'Purple Leaf'	Purple Leaf Ajuga	Lavender	5	6	3	15	8	7	6
Ajuga reptans 'Variegata'	Variegated Ajuga	Lavender	5	6	3	15	6	5	6
Allium thunbergii	Ornamental Onion	Lavender	8	10	10	8	5	5	5
Anacyclus depressus	Atlas Daisy	White	4	6	3	10	8	7	7
Androsace lanuginosa	Rock Jasmine	Lavender	5	6	2	3	6	5	5
Androsace sarmentosa	Strawberry Androsace	Pink	5	6	3	10	6	5	5
Androsace sempervivioides	Rosette Androsace	Pink	4	6	2	8	6	6	5
Andryala agardhii	Spanish Daisy	Yellow	5	6	5	8	8	6	7
Anemone canadensis	American Wood Anemone	White	5	6	12	24	6	6	6
Antennaria rosea	Pussytoes	Pink	5	6	3	10	8	9	7
Anthemis montana	Silverleaf Daisy	White	6	7	12	15	8	7	7
Aquilegia 'Biedermeier Dwarf	Biedermeier Columbine	Mixed	4	5	10	10	6	5	5
Aquilegia barnebyi	Barneby's Columbine	Yellow	5	6	15	10	7	7	6
Aquilegia chrysantha	Yellow Columbine	Yellow	5	6	20	12	5	4	6
Aquilegia discolor	Columbine	Blue	5	6	6	6	4	7	6
Aquilegia elegantula	Dwarf Red Columbine	Red	5	6	15	10	6	5	5
Aquilegia flabellata	Fanleaf Columbine	Blue	4	5	8	6	6	6	6
Aquilegia flabellata var. kurilensis	Kurile Columbine	Pink	5	6	5	5	6	5	5
Aquilegia jonesii	Cushion Columbine	Purple	3	4	5	5	8	8	7
Aquilegia saximontana	Rocky Mt. Dwarf Columbine	Blue	4	7	7	7	6	5	6
Aquilegia viridiflora	Black Columbine	Black	4	5	14	8	7	7	6
Aquilegia vulgaris	Common Columbine	Purple	5	6	15	15	5	5	5
Arabis blepharophylla	California Arabis	Pink	4	6	9	4	5	6	6
Arabis caucasica	Wallcress	White	4	6	5	18	6	6	6
Arabis caucasica 'Snow Cap'	Snow Cap Wallcress	White	4	6	6	12	6	6	6
Arabis caucasica 'Spring Charm'	Wallcress	White	4	6	6	12	6	6	6
Arabis caucasica 'Variegata'	Wallcress	White	4	5	8	12	6	6	6
Arabis ferdinandi-coburgi 'Variegata'	Variegated Wallcress	White	4	5	1	12	7	7	7
Arctostaphylos nevadensis	Mat Manzanita	White	3	5	8	18	7	7	7
Arctostaphylos uva-ursi	Kinnikinick	White	3	5	4	20	8	7	7
Arenaria tetraquetra	Spanish Sandwort	White	5	7	1	7	7	6	6
Armeria caespitosa	Pink Sea Thrift	Pink	5	6	3	8	7	5	6
Armeria maritima	Sea Thrift	Pink	5	7	7	12	7	5	6
Armeria maritima, dwarf	Dwarf Sea Thrift	Pink	4	7	4	6	7	7	7
Artemisia frigida	Dwarf Sage	Gray	6	8	8	12	8	6	7
Artemisia schmidtiana 'Silver Mound'	Silver Mound Sage	Gray	7	8	12	10	7	7	6
Artemisia stelleriana	Perennial Dusty Miller	Gray	7	8	15	15	8	7	6
Asarum europaeum	European Wild Ginger	Brown	6	7	4	10	5	4	4
Asperula gussonii	Corsican Woodruff	Pink	5	7	2	10	7	6	6
Aster alpinus	Alpine Aster	Lavender	5	6	8	10	7	5	6
Aster novi-belgii 'Melba'	Melba Aster	Pink	8	9	12	12	8	7	7
Aster novi-belgii 'Professor Kippenberg'	Kippenberg Aster	Blue	8	9	12	12	8	7	7
Aster novi-belgii 'Snow Flurry'	Snow Flurry Aster	White	8	9	12	12	8	7	7

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Astilbe chinensis v. pumila	Dwarf Astilbe	Purple	7	9	10	10	5	5	5
Aubrieta deltoidea	Rock Cress	Purple	4	6	3	12	6	6	6
Aurinia saxatile	Basket of Gold	Yellow	5	6	12	12	8	6	6
Azalea x 'nakahari'	Dwarf Azalea	Red	5	6	10	15	5	3	4
Belamcanda chinensis	Blackberry Lily	Orange	6	7	24	8	8	6	6
Bergenia cordifolia	Leatherleaf	Pink	4	5	14	14	5	5	5
Bolax glebaria	Azorella	Yellow	6	7	2	12	7	4	6
Brunnera macrophylla	Elephant Ear Forget-Me-Not	Blue	5	6	10	20	4	6	6
Buxus microphylla	Dwarf Boxwood	--	--	--	6	8	5	5	5
Callirhoe involucrata	Wine Cups, Poppy Mallow	Purple	6	10	5	20	8	7	8
Calluna vulgaris	Heather	Pink	6	8	8	12	5	3	5
Campanula allionii	Alpine Bluebell	Blue	5	6	2	8	7	7	6
Campanula carpatica 'Blue Clips'	Carpathian Harebell	Blue	6	9	8	10	8	6	6
Campanula carpatica 'White Clips'	White Carpathian Harebell	White	6	9	8	10	8	6	6
Campanula cochlearifolia	Fairybells	Blue	6	8	3	15	7	6	6
Campanula cochlearifolia 'Alba'	White Fairybells	White	6	7	3	12	7	6	6
Campanula formanekiana	Cup Bellflower	White	5	6	10	10	8	7	7
Campanula garganica	Adriatic Bellflower	Blue	5	6	6	10	7	6	6
Campanula persicifolia	Peach Leaf Bellflower	Blue	5	7	12	9	7	6	6
Campanula portenschlagiana	Adriatic Campanula	Blue	6	7	3	10	7	6	7
Campanula poscharskyana	Serbian Bellflower	Blue	6	8	5	18	7	7	6
Campanula rotundifolia	Harebell	Blue	5	9	9	4	6	6	6
Cerastium tomentosum	Snow-in-Summer	White	6	7	6	20	8	7	6
Cerastium tomentosum 'YoYo'	Dwarf Snow-in-Summer	White	6	7	6	8	8	7	6
Ceratostigma plumbaginoides	Plumbago	Blue	8	10	9	12	6	5	5
Chamaecyparis obtusa	Dwarf Hinoki Cypress	--	--	--	36	20	5	4	5
Cheiranthus allionii	Siberian Wallflower	Orange	4	6	12	7	8	7	6
Chrysanthemum weyrichii 'Pink Bomb'	Ground Cover Mum	White	8	10	9	12	7	6	6
Coreopsis lanceolata	Coreopsis	Yellow	6	9	20	15	8	7	7
Coreopsis lanceolata 'Baby Sun'	Single Dwarf Coreopsis	Yellow	6	9	10	10	8	7	7
Coreopsis lanceolata 'Brown Eyes'	Brown Eye Coreopsis	Yellow	6	8	12	12	8	7	6
Cytisus x kewensis	Kew Broom	Cream	5	5	8	36	8	7	7
Daphne caucasica	Daphne	White	5	6	36	18	5	5	8
Daphne cneorum	Garland Flower	Pink	4	5	8	15	7	6	5
Daphne x burkwoodii 'Carol Mackie'	Carol Mackie Daphne	White	5	6	45	60	7	5	6
Daphne x burkwoodii 'Somerset'	Somerset Daphne	White	5	6	25	35	7	5	5
Delosperma cooperi	Hardy Iceplant	Purple	5	10	2	12	9	8	7
Delosperma nubigenum	Hardy Iceplant	Yellow	4	6	1	15	8	7	6
Delphinium grandiflorum	Himalayan Larkspur	Blue	6	8	15	8	7	6	6
Dianthus alpinus	Alpine Pink	Pink	5	6	2	8	7	6	6
Dianthus anatolicus	Anatolian Pink	Pink	5	7	12	14	8	7	7
Dianthus barbatus 'Pixie'	Pixie Pink	Pink	5	6	6	10	7	6	6
Dianthus deltoides	Maiden Pink	Pink	5	6	8	8	7	6	6
Dianthus deltoides 'Zing Rose'	Zing Rose Pink	Pink	5	6	8	8	7	6	6
Dianthus erinaceus	Hedgehog Pink	Pink	6	7	2	8	7	7	7
Dianthus freynii	Cushion Pink	Pink	4	6	3	8	8	7	7
Dianthus graniticus	Granada Pink	Pink	5	7	8	12	8	7	7
Dianthus gratianopolitanus 'Tiny Rubies'	Tiny Rubies Pink	Pink	5	6	3	9	8	7	6
Dianthus nardiformis	Cloud Pink	Pink	6	10	10	12	9	7	7
Dianthus nitidus	Balkan Pink	Pink	5	6	6	4	8	7	6
Dianthus noeanus	Rock Pink	White	6	7	8	10	8	7	7
Dianthus pavonius	Maritime Alps Pink	Pink	4	5	6	6	8	7	6

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Dianthus plumarius v. lumnitzeri	Spice Pink	White	5	6	8	10	8	7	6
Dianthus subacaulis	Blueleaf Pink	Pink	5	6	2	8	8	6	6
Dianthus sylvestris v. frigidus	Alpine Pink	White	6	7	12	12	8	7	6
Dicentra eximia	Fringed Bleeding Heart	Pink	5	7	9	12	4	5	5
Dodecatheon pulchellum	Western Shooting Star	Pink	5	6	12	5	7	5	3
Doronicum caucasicum	Leopard's Bane	Yellow	5	6	24	12	7	6	5
Draba aizoides	Common Draba	Yellow	3	5	2	4	8	7	7
Draba bruniifolia	Cushion Draba	Yellow	3	4	3	12	8	7	6
Draba hispanica	Spanish Draba	Yellow	3	4	3	10	8	7	7
Draba oligosperma	Mat Draba	Yellow	3	4	2	7	8	7	7
Draba rigida	Bun Draba	Yellow	3	4	3	6	8	7	6
Dracocephalum botryoides	Cutleaf Dragonhead	Purple	5	7	3	9	8	7	7
Dryoptexis erythrosora	Autumn Fern	Rd(Spring)		--	--	36	15	5	4
Epimedium grandiflorum	Barrenwort	Purple	5	6	10	10	4	4	5
Epimedium x sulphureum	Sulfur Barrenwort	Yellow	4	5	12	15	6	5	5
Erigeron chrysopsidis brevifolius 'Grand Ridge'	Cutleaf Fleabane								
Erigeron compositus	Cutleaf Fleabane	White	4	9	3	3	8	8	8
Erigeron speciosus	Showy Fleabane	Blue	5	7	15	10	8	7	7
Erigeron trifidus	Cutleaf Daisy	White	5	8	5	7	8	7	7
Eriogonum subalpinum	Subalpine Sulfur Flower	Yellow	5	7	8	10	8	8	8
Eriogonum umbellatum	Sulfur Flower	Yellow	5	7	10	10	8	8	8
Eryngium alpinum	Alpine Sea Holly	Silver	6	7	12	8	7	7	5
Eschscholzia californica	California Poppy	Orange	5	9	5	8	6	6	7
Euonymus fortunei 'Coloratus'	Variegated Euonymus	Green	4	5	15	20	6	6	6
Euonymus fortunei 'Kewensis'	Kew Euonymus	Green	--	--	3	12	6	5	6
Euphorbia epithymioides (syn. *polychroma*)	Spring Spurge	--	--	--	0	0	0	0	0
Euphorbia myrsinites	Succulent Spurge	Yellow	3	5	3	15	8	8	8
Fragaria americana	Wild Strawberry	White	5	7	6	8	7	7	7
Fragaria vesca	Runnerless Strawberry	White	5	7	8	8	7	7	7
Gaillardia x grandiflora 'Burgundy'	Indian Blanket	Burgundy	5	9	10	10	8	8	7
Gaillardia x grandiflora 'Goblin'	Indian Blanket	Orange	5	10	10	12	8	7	7
Galium odoratum	Sweet Woodruff	White	5	6	8	12	4	4	6
Gentiana acaulis	Trumpet Gentian	Blue	4	6	3	8	7	5	5
Gentiana loderi	Loder's Gentian	Blue	6	7	5	8	7	6	6
Gentiana septemfida	Summer Gentian	Blue	7	9	10	10	8	7	6
Gentiana sino-ornata	Himalayan Gentian	Blue	7	9	3	7	7	4	5
Gentiana triflora	Japanese Gentian	Blue	6	8	25	8	7	5	5
Gentiana verna	Star Gentian	Blue	4	5	2	6	8	4	4
Geranium 'Johnson's Blue'	Johnson's Blue Crane's Bill	Blue	5	7	15	15	7	6	6
Geranium endressii 'Wargrave Pink'	Meadow Crane's Bill	Pink	6	8	18	10	7	6	6
Geranium macrorrhizum	Balkan Crane's Bill	Pink	5	7	10	18	6	7	8
Geranium sanguineum	Bloody Crane's Bill	Magenta	5	8	15	30	8	7	6
Geranium sanguineum v. lancastriense	Lancaster Crane's Bill	Pink	6	7	4	12	8	7	6
Geum borisii	Balkan Geum	Orange	6	7	12	10	7	7	7
Geum chiloense 'Mrs. Bradshaw'	Mrs Bradshaw's Geum	Pink	5	7	15	12	7	6	6
Globularia punctata	Clump Globularia	Blue	5	6	9	5	7	6	6
Gypsophila repens	Dwarf Baby's Breath	Pink	5	7	4	12	8	7	6
Gypsophila repens 'Rosea'	Rose Baby's Breath	Pink	5	6	7	15	8	7	7
Hebe 'Carl Teschner'	Carl Teschner Hebe	Blue	5	6	4	10	6	5	4
Hebe carnosula	Green Hebe	White	4	5	10	15	8	7	6
Hebe pimelioides	Pimelia Hebe	Lavender	7	8	12	10	7	6	6

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Hebe pinguifolia 'Pagei'	Page's Hebe	White	6	7	5	12	8	7	6
Hedera helix	English Ivy	Green	6	8	4	12	4	4	4
Hedera helix 'Green Finger'	Green Finger Ivy	Green	--	--	50	20	6	5	5
Helianthemum guttatum	Gray Sunrose	White	5	7	10	18	8	7	6
Helianthemum numullarium	Sunrose	Mixed	5	8	8	15	8	7	7
Helichrysum virgineum	Mt. Athos Everlasting	Mhite	5	6	8	12	8	7	7
Helleborus niger	Christmas Rose	White	1	4	10	10	6	5	5
Herniaria glabra	Rupturewort	Green	4	5	1	10	8	6	6
Heuchera cylindrica var. glabella	Alumroot	White	5	6	8	8	6	6	6
Heuchera sanguinea	Coralbells	Red	5	9	15	8	6	5	5
Hosta lancifolia	Lanceleaf Hosta	Lavender	7	8	15	10	5	5	5
Hosta sieboldiana	Blueleaf Hosta	Lavender	8	9	36	20	5	6	5
Hosta undulata	Undulate Hosta	Lavender	8	9	15	10	5	5	5
Hutchinsia alpina	Hutchinsia	White	4	5	2	7	7	6	6
Hypericum reptans	Creeping St.John's Wort	Mixed	5	8	0	0	8	7	7
Iberis gibraltarica	Gibraltar Candytuft	White	4	6	12	10	8	7	7
Iberis sayana	Candytuft	White	5	6	2	12	7	7	7
Iberis sempervirens	Candytuft	White	5	6	10	14	8	7	7
Ilex sp. 'Rock Garden'	Dwarf Holly	--	--	--	12	5	4	5	
Iris missouriensis	Native Blue Iris	Blue	4	5	18	12	8	7	5
Iris pumila	Dwarf Bearded Iris	Assorted	3	4	3	6	8	7	7
Iris setosa v. canadensis	Canadian Iris	Ppurple	5	5	8	8	5	5	5
Juniperis communalis compressa	Dwarf Irish Juniper	--	--	--	30	12	5	5	5
Lamium maculatum 'Beacon Silver'	Silver Nettle	Pink	6	7	3	12	6	4	5
Leontopodium alpinum	Edelweiss	White	6	7	6	6	6	6	6
Lewisia cotyledon	Bitter Root	Pink	5	6	12	10	6	6	6
Liatris punctata	Blazing Star	Purple	7	9	10	5	8	8	8
Liatris spicata	Spiked Gayfeather	Lavender	7	9	12	12	8	8	7
Limonium latifolium	Purple Sea Lavender	Lavender	7	9	24	12	8	7	7
Linum flavum	Yellow Flax	Yellow	5	6	12	10	8	7	7
Linum flavum 'Compactum'	Dwarf Yellow Flax	Yellow	5	6	8	10	8	7	7
Linum perenne	Blue Flax	Blue	5	7	18	10	8	7	6
Lobelia cardinalis	Cardinal Flower	Red	8	9	30	10	5	5	4
Lysimachia nummularia	Moneywort	Yellow	5	6	2	45	6	5	6
Machaeranthera coloradoensis	Colorado Aster	Pink	4	6	3	6	8	7	7
Mahonia repens	Creeping Grape Holly	Yellow	5	6	12	14	7	7	8
Malva moschata 'Alba'	White Musk Mallow	White	5	8	18	10	7	6	7
Matricaria matricarioides 'Golden Feather'	Feverfew	Yellow	5	8	15	8	7	7	7
Melampodium leucanthum	Blackfoot Daisy	White	7	9	10	10	8	8	8
Mimulus cardinalis	Monkeyflower	Red	7	8	18	18	5	5	7
Mimulus guttatus	Monkeyflower	Yellow	5	7	3	8	7	4	3
Monarda didyma 'Cambridge Scarlet'	Bee Balm	Red	6	8	24	20	8	7	6
Myosotis alpestris 'Indigo Blue'	Indigo Forget-Me-Not	Blue	4	5	4	6	7	6	6
Myosotis rupicola	Dwarf Forget-Me-Not	Blue	4	5	5	4	6	5	6
Oenothera missouriensis	Missouri Evening Primrose	Yellow	5	7	8	12	8	7	7
Origanum libanoticum	Lebanese Oregano	Pink	7	9	10	15	8	7	8
Papaver alpinum	Alpine Poppy	Assorted	5	8	5	4	8	6	6
Papaver miyabeanum	Miyabe's Poppy	Yellow	5	6	6	3	7	6	6
Papaver nudicaule	Iceland Poppy	Orange	5	6	14	6	8	5	6
Parthenocissus tricuspidata	Boston Ivy	--	--	--	4+	--	0	0	0
Paxistima canbyi	Ratstriper	Brown	5	6	8	12	7	6	6

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Paxistima myrsinites	Mountainlover	Brown	5	6	20	10	5	6	7
Penstemon alpinus	Mountain Penstemon	Blue	5	6	18	6	7	6	6
Penstemon ambiguus	Phlox Penstemon	White	6	9	12	7	9	8	8
Penstemon barbatus	Shark's Head Penstemon	Red	6	7	36	8	8	7	8
Penstemon barbatus 'Schooley's Yellow'	Yellow Penstemon	Yellow	6	7	36	8	8	7	8
Penstemon cardinalis	Cardinal Penstemon	Red	7	8	25	8	8	8	8
Penstemon cardwellii	Cascade Penstemon	Lavender	4	5	10	18	6	6	6
Penstemon cardwellii 'Roseus'	Rose Penstemon	Pink	4	5	8	10	6	6	5
Penstemon davidsonii	Davidson's Penstemon	Purple	4	5	1	8	7	6	6
Penstemon digitalis	Foxglove Penstemon	White	6	8	30	10	7	6	6
Penstemon eatonii	Firecracker Penstemon	Red	6	7	30	8	7	8	7
Penstemon fruticosus	Shrubby Penstemon	Lavender	5	6	12	18	7	6	6
Penstemon fruticosus v. serratus 'Holly'	Holly Penstemon	Lavender	4	5	3	6	7	6	6
Penstemon grandiflorus	Shell-leaf Penstemon	Pink	5	6	25	8	8	6	6
Penstemon hallii	Hall's Penstemon	Purple	4	5	7	10	8	7	7
Penstemon jamesii	James' Penstemon	Lavender	5	6	15	7	8	8	8
Penstemon linarioides	Toadflax Penstemon	Lavender	5	7	10	12	7	7	8
Penstemon linarioides v. coloradoensis	Silvermat Penstemon	Blue	5	6	8	12	8	7	7
Penstemon ovatus	Ovate Penstemon	Blue	5	6	12	8	7	7	7
Penstemon palmeri	Palmer Penstemon	Pink	6	8	60	15	8	7	7
Penstemon pinifolius	Pineleaf Penstemon	Red	6	9	10	15	8	7	7
Penstemon richardsonii	Richardson's Penstemon	Pink	7	9	18	18	8	8	8
Penstemon rostriflorus	Bridge's Penstemon	Red	6	9	28	30	8	7	7
Penstemon secundiflorus	One-sided Penstemon	Lavender	5	6	20	8	8	8	8
Penstemon serrulatus	Sawtooth Penstemon	Lavender	5	6	15	15	7	7	7
Penstemon strictus 'Bandera'	Bandera Penstemon	Blue	5	6	25	8	8	7	7
Penstemon teucrioides	Germander Penstemon	Blue	5	6	1	8	7	6	6
Penstemon thompsoniae	Grayleaf Penstemon	Purple	5	6	1	10	8	8	8
Penstemon virens	Foothills Penstemon	Blue	4	5	10	8	7	7	6
Penstemon whippleanus	Whipple's Penstemon	Purple	6	7	15	8	7	6	6
Perovskia atriplicifolia	Russian Sage	Lavender	7	10	60	50	9	8	8
Phlox 'Arroyo'	Mexican Phlox	Pink	5	10	10	12	8	7	6
Phlox 'Crimson Beauty'	Mexican Phlox	Crimson	4	6	3	20	8	6	6
Phlox 'Daniel's Cushion'	Mexican Phlox	Lavender	4	6	3	20	8	6	6
Phlox 'Manzana'	Mexican Phlox	Pink	6	9	8	10	8	7	6
Phlox 'Mary Maslin'	Mexican Phlox	Red	6	9	8	10	8	7	6
Phlox 'Paul Maslin'	Mexican Phlox	Yellow	6	9	8	10	8	7	6
Phlox 'Tangelo'	Mexican Phlox	Orange	6	9	10	12	8	7	6
Phlox 'Vanilla'	Mexican Phlox	White	6	9	8	10	8	7	6
Phlox 'White'	Mexican Phlox	White	6	9	8	10	8	7	6
Phlox bifida	Cleft Phlox	Blue	5	6	6	12	7	5	5
Phlox 'Boothman's Variety'	Creeping Phlox	Lavender	4	6	3	18	8	7	6
Phlox bifida 'Colvin's White'	Cleft Phlox	White	5	5	8	12	7	5	5
Phlox subulata	Creeping Phlox	Pink	4	5	2	12	7	6	6
Phlox subulata 'Ronsdorf Beauty'	Dwarf Creeping Phlox	Pink	4	5	1	8	7	6	6
Picea abies 'Little Gem'	Min. Birds Nest Spruce	--	--	--	12	12	5	5	6
Platycodon grandiflorus 'Apoyama'	Dwarf Balloon Flower	Blue	6	7	8	8	7	7	7
Platycodon grandiflorus v. mariesii	Balloon Flower	Blue	6	8	20	8	7	7	6
Polygonum affine	Border Jewel	Pink	7	9	15	30	8	7	7
Polygonum cuspidatum v. compactum	Knotweed	Pink	6	8	30	20	8	7	7
Potentilla argyrophylla v. atrosanguinea	Scarlet Cinquefoil	Red	5	6	12	8	9	6	6

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SPD	SN	S	W
Potentilla hippiana	Horse Cinquefoil	Yellow	6	7	12	10	8	7	7
Potentilla tabernae-montana	Carpet Cinquefoil	Yellow	4	6	2	15	7	6	5
Potentilla tabernae-montana var. nana	Cushion Cinquefoil	Yellow	5	6	2	7	8	7	7
Potentilla thurberi	Thurber's Cinquefoil	Red	7	9	28	10	7	7	7
Potentilla verna nana	Cushion Chinquefoil	Yellow	5	6	2	10	7	6	6
Primula auricula	Auricula Primrose	Mix	4	5	6	8	5	6	5
Primula denticulata	Drumstick Primrose	Pink	3	4	8	6	5	5	5
Primula elatior	Oxlip Primrose	Yellow	4	5	8	6	5	5	5
Primula juliae	Juliana's Primrose	Purple	4	5	2	6	5	5	3
Primula saxatilis	Siberian Primrose	Pink	5	6	12	8	5	5	5
Primula sieboldii	Woodland Primrose	Pink	4	5	8	9	5	5	5
Primula veris	Cowslip Primrose	Yellow	4	5	8	6	5	5	5
Ptilotrichum spinosum 'Roseum'	Spiny Alyssum	Purple	5	6	10	14	8	8	8
Ranunculus gramineus	Buttercup	Yellow	5	7	10	6	7	7	7
Ranunculus repens	Creeping Buttercup	Yellow	5	6	6	20	8	6	6
Raoulia australis	N. Zealand Scabplant	Yellow	6	7	1	10	8	6	5
Rhododendron H-1	Rhododendron	Wht/Pnk	5	6	36	24	4	3	6
Rhododendron yakushinanum	Rhododendron	White	5	6	36	36	4	3	6
Rosularia aizoon	Rosularia	Yellow	5	6	6	5	7	6	7
Rosularia chrysantha	Hairy Rosularia	Yellow	5	6	6	10	8	7	7
Salix hylomatica	Nepalese Willow	Red	4	4	3	24	7	7	3
Salvia argentea	Silver Sage	White	6	7	30	18	8	7	8
Santolina chamaecyparissus	Lavender Cotton	Yellow	6	8	25	30	8	7	7
Saponaria ocymoides 'Rubra Compacta'	Soapwort	Pink	5	5	3	12	7	7	7
Saponaria ocymoides 'Splendens'	Soapwort	Pink	5	6	8	15	8	7	7
Saxifraga caespitosa	Purple Robe Saxifrage	Red	4	6	7	15	5	5	5
Saxifraga cotyledon	Silver Saxifrage	White	5	6	25	10	6	6	6
Saxifraga ferdinandi-coburgi	Balkan Saxifrage	Yellow	3	4	3	12	6	6	5
Saxifraga moschata v. kingii	Small Mossy Saxifrage	White	5	6	3	20	5	6	5
Saxifraga paniculata	Silver Saxifrage	White	5	6	6	10	6	5	6
Saxifraga paniculata 'Millstream'	Red Silverleaf Saxifrage	Red	5	6	12	8	6	6	5
Saxifraga x 'Mossy Variegated'	Variegated Mossy Saxifrage	White	5	6	6	12	4	4	5
Scabiosa graminifolia	Grassleaf Scabious	Lavender	6	8	10	10	8	7	7
Sedum acre	Sedum	Yellow	5	6	3	15	8	8	8
Sedum hybridum	Double-flowering Sedum	Yellow	5	9	3	10	8	8	8
Sedum kamtschaticum	Kamtschatka Sedum	Yellow	6	9	5	10	8	8	8
Sedum kamtschaticum 'Variegatum'	Variegated Stonecrop Sedum	Yellow	6	8	3	10	6	6	6
Sedum pachyclados	Pakistan Stonecrop Sedum	White	6	7	3	8	7	6	6
Sedum sieboldii	Autumn Sedum	Pink	8	9	5	10	7	6	5
Sedum spathulifolium 'Cape Blanco'	Pacific Sedum	Yellow	5	6	3	7	5	6	5
Sedum spurium 'Red Carpet'	Dragon's Blood Sedum	Pink	7	8	4	12	8	8	8
Sempervivum arachnoideum	Cobweb Houseleek	Pink	6	8	7	10	8	7	6
Sempervivum ciliosum 'Borisii'	Balkan Houseleek	Yellow	5	6	7	8	8	7	6
Silene acaulis	Moss Campion	Pink	4	5	1	8	7	6	5
Silene glauca	Beach Catchfly	White	5	6	4	10	7	5	5
Silene schafta	Fall Catchfly	Pink	7	9	3	8	7	6	6
Sisyrinchium convolutum	Yellow-eyed Grass	Yellow	5	6	8	4	8	6	5
Sisyrinchium montanum	Blue-eyed Grass	Blue	5	6	8	4	7	5	5
Stachys lanata	Lamb's Ears	Pink	5	6	15	15	8	7	7
Stanleya pinnata	Prince's Plume	Yellow	5	6	30	15	8	8	8
Talinum calycinum	Fameflower	Purple	7	10	15	8	8	7	8

Table 5. Rock Alpine / Ground Covers, continued...

LATIN NAME	COMMON NAME	COLOR	B	FHTSPD			SN	S	W
Talinum spinescens	Spiny Fameflower	Pink	6	8	6	8	9	8	7
Tanacetum densum var. amani	Partridge Feather	Yellow	6	7	10	15	6	7	7
Teucrium chamaedrys 'Prostratum'	Creeping Germander	Pink	7	9	8	15	8	7	8
Thalictrum aquilegifolium	Columbine Meadow Rue	Lavender	5	6	30	15	6	5	5
Thymus 'Peter Davis'	Peter Davis' Thyme	Lavender	5	6	7	10	7	7	7
Thymus doerfleri	Hairy Thyme	Lilac	6	7	1	7	8	7	7
Thymus glabrescens v. loevyanus	Bigleaf Mat Thyme	Lilac	6	7	2	18	8	7	8
Thymus herba-barona	Carroway Thyme	Lavender	6	7	1	18	8	8	8
Thymus necefii	Crossleaf Thyme	Pink	4	5	2	10	8	7	7
Thymus pseudolanuginosus	Wooly Thyme	Lavender	6	7	1	12	8	8	8
Thymus serpyllum 'Minus'	Dwarf Thyme	Lavender	6	7	1	6	8	7	7
Thymus vulgaris 'Argenteus'	Silver Thyme	Lavender	6	7	8	10	8	7	7
Thymus x citriodorus (pulegioides x vulgaris)	Lemon Thyme	Lavender	6	7	1	15	8	7	7
Townsendia grandiflora	Giant Easter Daisy	White	4	5	4	6	8	7	7
Verbena bipinnatifida	Native Verbena	Purple	5	9	3	10	8	8	8
Veronica bombycina	White-leaf Speedwell	Blue	5	6	2	6	8	7	8
Veronica cinerea	Gray Veronica	Blue	5	6	5	12	8	7	7
Veronica filiformis	Bird's Eye Veronica	Blue	4	5	1	9	7	6	6
Veronica incana	Silver Speedwell	Blue	6	7	12	10	7	7	7
Veronica liwanensis	Turkish Veronica	Blue	4	6	1	15	8	7	8
Veronica orientalis	Oriental Veronica	Blue	5	6	5	12	8	7	7
Veronica pectinata	Blue Wooly Veronica	Blue	4	6	3	12	8	7	7
Veronica pectinata 'Rosea'	Wooly Veronica	Pink	5	6	2	9	8	7	7
Veronica prostrata	Mat Veronica	Blue	5	6	3	18	7	7	7
Veronica repens	Creeping Veronica	Blue	4	5	3	10	8	7	7
Veronica spicata 'Red Fox'	Pink Speedwell	Pink	5	6	12	10	8	7	7
Vinca minor	Periwinkle	Blue	3	5	8	18	5	5	5
Viola cornuta	Horned Violet	Mix	5	6	6	10	6	5	5
Viola corsica	Corsican Viola	Purple	3	9	5	7	7	6	5
Waldsteinia ternata	Barren Strawberry	Yellow	4	12	4	10	5	6	6
Zauschneria californica	Fire Chalice	Red	7	10	7	15	8	7	7
Zinnia grandiflora	Hardy Zinna	Yellow	6	10	3	12	9	9	1

Table 6, Summer Bulbs.
Janet Sickafuse, Chairman

[**B** = beginning month of bloom; **F** = final month of bloom; **HT** = height, in inches; **SP** = spread, in inches; **S** = Sun requirements: 1 = full shade, 9 = full sun; **SL** = soil requirements: 1 = acid peat, 9 = alkaline clay; **W** = water requirements: 1 = wet, 9 = dry; **D** = planting depth, in inches; **G** = suggested number in a group; **H**: H = hardy, T = tender]

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	SL	W	D	G	H
Acidanthera bicolor 'Murielae'	Abyssinian Gladiolus	White/Maroon	8	9	30	6	7	5	6	2	10	T
Canna x 'City of Portland'	Canna	Salmon Pink	7	9	48	24	7	4	5	2	3	T
Canna x 'Pfitzer's Primrose'	Canna	Yellow	7	9	24	24	7	4	5	2	3	T
Canna x 'Lucifer'	Canna	Yellow/Red	7	9	24	24	7	4	5	2	3	T
Canna x 'The President'	Canna	Red	7	9	36	24	7	4	5	2	3	T
Crocosmia x crocosmiflora	Montbretia	Mixed	7	7	20	4	6	5	7	2	10	--
Dahlia x 'Apache'	Dahlia	Orange Red	7	9	48	24	7	4	6	6	1	T
Dahlia x 'Christina'	Dahlia	Lilac/White	7	9	48	24	7	4	6	6	1	T
Dahlia x 'David Howard'	Dahlia	Orange	7	9	48	24	7	4	6	6	1	T
Dahlia x 'Eveline'	Dahlia	White	7	9	48	24	7	4	6	6	1	T

Table 6. Summer Bulbs, continued. . .

LATIN NAME	COMMON NAME	COLOR	B	F	HT	SP	S	SL	W	D	G	H
Dahlia x 'Garden Wonder'	Dahlia	Deep Red	7	9	48	24	7	4	6	6	1	T
Dahlia x 'Golden Emblem'	Dahlia	Bright Yellow	7	9	48	24	7	4	6	6	1	T
Dahlia x 'Pinwheel'	Dahlia	Red/White	7	9	48	24	7	4	6	6	1	T
Dahlia x 'Rosella'	Dahlia	Rose Purple	7	9	48	24	7	4	6	6	1	T
Gladiolus nanus	Hardy Gladiolus	Mixed	6	6	18	6	7	5	6	2	10	H
Gladiolus x *hortulanus*	Garden Gladiolus	Mixed	7	8	54	6	7	5	6	5	3	T
Liatris spicata	Gayfeather	Purple	8	9	12	12	8	7	7	1	5	H
Liatris spicata alba	White Gayfeather	White	8	9	12	12	8	7	7	1	5	H
Lilium tigrinum	Tiger Lily	Assort.	8	9	60	6	5	6	7	5	3	H
Lilium x 'Black Dragon'	Trumpet Lily	Maroon/White	8	9	72	6	6	5	7	5	3	H
Lilium x 'Blushing Pink'	Oriental Lily	Pink/White	7	8	60	6	5	4	7	5	3	H
Lilium x 'Brushmarks'	Asiatic Lily	Orange/Red	6	6	36	6	6	5	7	5	3	H
Lilium x 'Casa Blanca'	Oriental Lily	White	8	9	60	6	5	4	7	5	3	H
Lilium x 'Cherished'	Asiati Lilyc	Rich Pink	6	6	40	6	6	5	7	5	3	H
Lilium x 'Connecticut King'	Lily, Asiatic	Bright Yellow	6	7	36	6	6	5	7	5	3	H
Lilium x 'Enchantment'	Asiatic Lily	Nasturtium	6	7	36	6	6	5	7	5	3	H
Lilium x 'Grand Commander'	Rubrum Lily	Crimson Red	8	9	60	6	6	4	7	5	3	H
Lilium x 'Mabel Violet'	Trumpet Lily	Magenta Pink	6	6	30	6	6	5	7	5	3	H
Lilium x 'Red Knight'	Asiatic Lily	Cherry Red	6	7	36	6	6	5	7	5	3	H
Lilium x 'Star Gazer'	Oriental Lily	Crimson Red	8	8	36	6	6	4	7	5	3	H
Lilium x 'Sterling Star'	Asiatic Lily	Cream/White	6	7	60	6	6	5	7	5	3	H
Lilium x 'Tamara'	Asiatic Lily	Pink/Cream	6	6	36	6	6	5	7	5	3	H
Lilium x 'Unique'	Asiatic Lily	Pink/White	6	6	36	6	6	5	7	5	3	H
Lilium x 'Uchida'	Rubrum Lily	Rosy Red	8	9	30	6	6	4	7	5	3	H
Lilium x 'White Mountain'	Oriental Lily	White/Gold	7	8	60	6	5	4	7	5	3	H
Ornithogalum sp.	Star of Bethlehem	White	6	7	24	12	8	5	5	3	10	T
Polianthes tuberosa	Tuberose	White	7	8	30	4	6	5	5	2	5	T
Tigridia pavonia	Tigridia	Mixed	7	8	20	48	7	5	7	2	10	T

Table 7, Trees and Shrubs.

Eva Littlefield, Chairman

[**HT**: height, in feet; **SP**: spread, in feet; SN (sun): 1 = full shade, 9 = full sun; **SL** (soil): 1 = alkaline clay, 9 = acid peat; W (water): 1 = wet, 9 = dry]

LATIN NAME	COMMON NAME	TYPE	COLOR	HT	SP	SN	SL	W
Amelanchier alnifolia	Native Serviceberry	Shrub	White	12	8	9	8	8
Aronia arbutifolia	Red Chokeberry	Shrub	Red	12	8	9	8	8
Berberis thunbergi	Crimson Pygmy Barberry	Shrub	Yellow	5	6	9	5	2
Buddleia davidii 'Charming'	Butterfly Bush	Shrub	Pink	8	5	9	5	7
Buddleia davidii 'White Profusion'	Butterfly Bush	Shrub	White	8	5	9	5	7
Buxus sempervirens microphylla	Wintergreen Boxwood	Shrub	---	20	20	6	8	7
Caragana arborescens 'Winter Gem'	Dwarf Siberian Pea Shrub	Shrub	Yellow	10	6	9	8	9
Caryopteris x *clandonensis*	Blue Mist Spirea	Shrub	Blue	2	2	8	2	7
Cercocarpus ledifolius	Curlleaf Mtn. Mahogany	Shrub	---	20	12	9	5	9
Cercocarpus montanus	Mountain Mahogany	Shrub	---	20	12	9	5	9
Chaenomeles speciosa 'Texas Scarlet'	Flowering Quince	Shrub	Red	6	6	6	5	7
Chamabatiara sp.	Fernbush	Shrub	White	4	3	9	3	8
Chrysothamnus nauseosus pumila	Dwarf Blue Rabbitbrush	Shrub	Yellow	3	2	9	5	9
Chrysothamnus nauseosus greenei	Green Rabbitbrush	Shrub	Yellow	4	3	9	5	9
Cornus kousa	Kousa Dogwood	Shurb	White	20	20	8	5	5

Table 7. Trees and Shrubs, continued. . .

LATIN NAME	COMMON NAME	TYPE	COLOR	HT	SP	SN	SL	W
Cornus sericea 'Baileyi'	Baily Redtwig Dogwood	Shrub	White	10	8	5	5	4
Cornus sericea 'Isanti'	Isanti Dwarf Dogwood	Shrub	White	5	4	5	5	4
Cornus sericea 'Kelseyi'	Kelsey Dogwood	Shrub	White	2	1	5	5	4
Cotoneaster apiculata	Cranberry Cotoneaster	Shrub	Pink	3	4	7	4	7
Cotoneaster dammeri 'Coral Beauty'	Cotoneaster	Shrub	Coral	1	6	7	7	7
Cotoneaster divaricatus	Spreading Cotoneaster	Shrub	Pink	8	8	4	5	5
Cowania mexicana	Cliffrose	Shrub	Yellow	8	8	8	3	9
Cytissus x *praecox*	Warminster Broom	Shrub	Yellow	5	8	9	2	8
Daphne cneorum	Daphne	Shrub	Pink	3	2	4	6	2
Euonymus alata	Burning Bush	Shrub	---	10	8	6	5	5
Euonymus alata 'Compacta'	Dwarf Burning Bush	Shrub	---	4	4	6	5	5
Euonymus fortunei	Wintercreeper Euonymus	Shrub	White	1	20	5	5	7
Fallugia paradoxa	Apache Plume	Shrub	---	4	5	7	4	9
Forsythia x *intermedia* 'Northern Sun'	Forsythia	Shrub	Yellow	5	3	7	5	5
Hibiscus syriacus 'Diana', Others	Rose-of-Sharon	Shrub	Wht, Assort.	10	10	6	7	5
Hypericum calycinum 'Hidcote'	St. John's-wort	Shrub	Yellow	2	1	7	5	9
Ilex x *meservae* 'Blue Prince'	Holly	Shrub	---	7	5	5	2	2
Ilex x *meservae* 'Blue Princess'	Holly	Shrub	---	7	5	5	2	2
Ilex verticillata	Sparkle Berry	Shrub	White	6	4	9	8	2
Juniperus communis	Common Mt. Juniper	Shrub	---	10	8	5	4	7
Ligusturm vulgare 'Cheyenne'	Cheyenne Privet	Shrub	White	6	6	5	4	7
Ligusturm vulgare 'Lodense'	Lodense Privet	Shrub	White	4	2	6	5	7
Nandina domestica	Heavenly Bamboo	Shrub	White	3	2	5	5	7
Perovskia atriplicifolia	Russian Sage	Shrub	Purple	5	5	9	1	9
Philadelphus x 'Dwarf Minn. Snowflake'	Dwarf Mockorange	Shrub	White	10	10	5	7	5
Physocarpus opulifolius 'Darts Gold'	Ninebark	Shrub	Pink	9	6	6	5	6
Physocarpus nanus	Dwarf Ninebark	Shrub	White	2	2	6	4	6
Picea abies (selections)	Blue Spruce	Shrub	---	--	--	8	5	5
Picea pungens (selections)	Blue Spruce	Shrub	---	--	--	8	5	5
Pinus mugho	Mugho Pine	Shrub	---	15	15	9	6	8
Potentilla fruticosa 'Abbotswood'	Potentilla	Shrub	White	3	3	9	5	6
Potentilla fruticosa 'Gold Drop'	Potentilla	Shrub	Yellow	4	3	9	5	6
Potentilla fruticosa 'Gold Finger'	Potentilla	Shrub	Yellow	4	4	9	5	6
Potentilla fruticosa 'Jackmani'	Potentilla	Shrub	Yellow	6	6	8	5	8
Potentilla fruticosa 'Kathryn Dykes'	Potentilla	Shrub	Yellow	5	5	8	5	7
Potentilla fruticosa 'Tangerine'	Potentilla	Shrub	Yel-Org	2	4	9	5	9
Prunus tomentosa	Nanking Cherry	Shrub	White	6	5	7	5	5
Prunus virginiana 'Canada Red'	Chokecherry	Shrub	---	20	8	6	5	6
Pyracantha sp.(espaliered)	Firethorn	Shrub	White	10	--	7	5	9
Quercus gambelii	Gamble Oak	Shrub	---	15	12	8	6	9
Rhododendron x (varieties)	Rhododendron	Shrub	Var.	--	--	2	9	2
Rhus aromatica 'Gro Low'	Sumac	Shrub	Yellow	2	6"	7	9	7
Ribes alpinum	Alpine Currant	Shrub	Green	15	5	4	5	6
Rosa foetida bicolor	Austrian Copper Rose	Shrub	Yel/Red	6	4	7	5	7
Rosa rugosa 'Magnifica'	Rose, Rugosa	Shrub	Red	6	6	8	6	6
Rosa x 'Bonica'	Shrub Rose	Shrub	Pink	5	5	8	5	7
Salix discolor	Pussywillow	Shrub	---	20	20	9	3	3
Salix purpurea nana	Dwarf Artic Willow	Shrub	---	5	5	7	5	4
Spiraea japonica 'Little Princess'	Spirea	Shrub	Pink	5	5	6	5	5
Spirea nipponica	Snowmound Spirea	Shrub	White	5	5	8	5	9
Spirea x 'Anthony Waterer'	Spirea	Shrub	Red	4	3	6	6	5

Table 7. **Trees and Shrubs,** continued. . .

LATIN NAME	COMMON NAME	TYPE	COLOR	HT	SP	SN	SL	W
Syringa meyeri	Meyer's Lilac	Shrub	Violet	6	9	8	5	7
Syringa patula 'Miss Kim'	Dwarf Lilac	Shrub	Lavender	5	4	8	5	7
Syringa viliosa	Vilosa Lilac, Late	Shrub	Lavender	5	5	5	5	5
Syringa vulgaris	Common Lilac	Shrub	Purple	15	12	8	5	8
Syringa vulgaris	Common Lilac	Shrub	White	15	12	8	5	8
Syringa x *chinensis*	Chinese Lilac	Shrub	Lavender	10	8	8	5	7
Tamarix pentandra	Tamarisk	Shrub	Pink	15	10	9	3	5
Taxus cuspidata densiformus	Dwarf Yew	Shrub	---	4	8	2	5	4
Thuja occidentalis 'Hetz'	Hetz Arborvitae	Shrub	---	3	2	3	5	4
Viburnum dentatum	Arrowwood Viburnum	Shrub	White	8	10	6	4	5
Viburnum lantana	Wayfaring Tree	Shrub	White	15	12	5	5	5
Viburnum plicatum tomentosum 'Mariesii'	Doublefile Viburnun	Shrub	White	10	12	7	7	5
Viburnum prunifolium	Black Haw Viburnum	Shrub	White	15	10	5	5	5
Viburnum x 'Juddii'	Judd's Viburnum	Shrub	Pk/Wht	6	4	7	7	4
Yucca sp.	Yucca	Shrub	White	2	2	9	2	9
Acer platanoides 'Royal Red'	Red Maple	Tree	Gr/Yel	50	60	9	3	5
Aesculus glabra	Ohio Buckeye	Tree	Gr/Yel	40	40	6	7	4
Catalpa speciosa	Catalpa	Tree	White	60	40	5	7	5
Celtis occidentalis	Western Hackberry	Tree	---	60	60	9	5	5
Cercis canadensis	Eastern Redbud Eastern	Tree	Pink	25	10	5	4	5
Crataegus phaenopyrum 'Toba'	Washington Hawthorn	Tree	White	25	10	7	5	5
Gymnocladus dioicus	Kentucky Coffeetree	Tree	Gr/Wht	50	40	9	4	8
Magnolia x *loebneri* 'Merrill'	Magnolia	Tree	Yellow	20	12	7	5	5
Morus alba	Weeping Mulbery	Tree	Pink	6	6	7	5	7
Picea pungens glauca	Colorado Blue Spruce	Tree	---	100	30	8	5	5
Pinus aristata	Bristle Cone Pine	Tree	---	8	3	9	5	6
Pinus nigra	Austrian Pine	Tree	---	45	20	9	5	6
Pinus strobus	White Pine	Tree	---	60	20	9	2	7
Prunus cerasifera 'Newportii'	Newport Purple Plum	Tree	Pink	20	12	6	5	5
Quercus rubra	Northern Red Oak	Tree	---	60	40	8	4	5
Sorbus occidentalis	Mountain Ash	Tree	White	25	15	7	6	4

Table 8, Vegetables.
Knobby Brown, Chairman

[* denotes new varieties]

Artichoke	'Green Globe Improved'
Broccoli	'Green Duke'
Brussels Sprouts	'Jade Cross E'
Cabbage	'Emerald Cross'
Cabbage	'Ruby Perfection'
Cantalope	'Chaca'
Cauliflower	'Snow Crown'
Celery*	'Utah 52-70 R Improved'
Cucumber	'Sweet Success'
Eggplant	'Dusky'
Eggplant	'Easter Egg'
Eggplant	'Ichiban'
Leek	'Titan'
Melon, Honeydew	'Earli-Dew'
Okra	'Annie Oakley Hybrid'
Onion	'Walla Walla'
Onion	'Carmen Red'
Par-cel*	—
Pepper	'Gypsy'
Pepper, Anaheim chili	— —
Pepper, Bell	'Golden Summer Hybrid'
Pepper Bell	'New Ace'
Pepper, Bell	'Oriole'
Pepper, Bell	'Purple Bell'
Pepper, Bell	'Sweet Chocolate'
Pepper, Cherry	'Sweet Cherry'
Pepper, Chili	'Zippy'
Pepper, Hot Bell	'Mexi Bell'
Pepper, Jalapeno	'Jalapeno M'
Pumpkin	'Bushkin'
Pumpkin	'Jack Be Little'
Radicchio	'Giulio'
Squash, Acorn	'Table King'
Squash, Acorn	'Jersey Golden'
Squash, Patty Pan	'Sunburst'
Squash, Spaghetti	—
Squash, Zucchini*	'Green Magic'
Squash, Zucchini	'Gold Rush'
Tomatillo	—
Tomato	'Better Boy'
Tomato	'Celebrity'
Tomato	'Early Girl'
Tomato	'Park's Better Bush'
Tomato	'Superfantastic'
Tomato, Beefsteak	'Burpee's Supersteak'
Tomato, Cherry	'Gardener's Delight'
Tomato, Cherry	'Gold Nugget'
Tomato, Cherry	'Sweet Million'
Tomato, Yellow*	'Lemon Boy'
Tomato, Yellow	'Yellow Plum'
Watermelon	'Burpee Bush Sugar Baby'

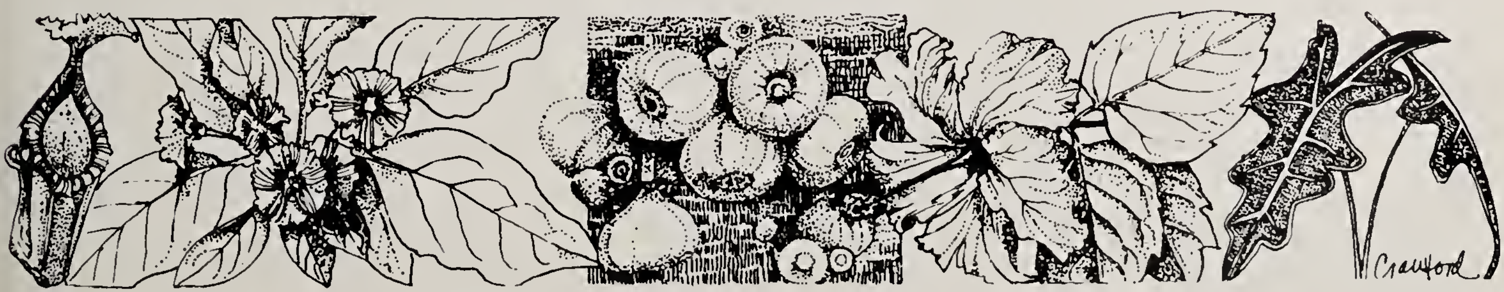
Table 9, Water Gardening.
Len and Doris Freestone, Chairmen

[**FL**=Flower type: Flt=floating, Cat=catkin, Lrg=large, Med=medium, Sml=small; **H**=Height, in inches; **Sp**=Spread, in inches; **BL**=Blooming time: Smr=summer, Sp=spring, F=fall; **S**=Sun requirement: 1=full shade, 9=full sun; **C**: P=perennial, A=annual; **H**: H=hardy, T=tender, F=half-hardy]

LATIN NAME	COMMON NAME	COLOR	FL	H	SP	BL	S	C	H
Azolla sp.	Azolla	---	Flt	---	---	Smr	5	P	T
Cannas	Water Canna	Yellow	---	48	---	Smr	9	A	T
Cannas	Water Canna	Red	---	48	---	Smr	9	A	T
Cannas	Water Canna	Pink	---	48	---	Smr	9	A	T
Colocasia esculenta	Green Taro	Yellow	---	36	---	Smr	7	P	T
Cyperus alternifolius	Umbrella Palm	---	---	72	---	---	6	P	T
Cyperus haspens	Dwarf Papyrus	---	---	30	---	30	7	A	T
Cyperus papurus	Giant Papyrus	---	---	72	---	smr	7	A	T
Eichornia crassipes	Water Hyacinth	Blue	Flt	---	---	Smr	7	A	T
Eleocharis tuberosa	Water Chestnut	---	---	36	---	Smr	7	A	T
Hydrocleys nymphoides	Water Poppy	Yellow	---	---	---	Smr	7	A	T
Iris pseudacorus	Iris, Yel Water	Yellow	---	48	---	Spg	9	P	H
Iris versicolor	Iris, Blue Water	Blue	---	24	---	Sp	7	P	H
Jussiaea repens	Primrose Creeper	Yellow	---	---	---	Smr	9	A	T
Lemna minor	Duck Weed	---	Flt	---	---	Smr	5	A	T
Marsilia mutica	Water Four Leaf Clover	---	---	---	---	Smr	5	A	T
Myriophyllum aquaticum	Parrot's feather	---	---	---	---	Smr	7	P	H
Nymphaea odorata gigantea	Water lily	White	Lrg	---	4'+	Smr	9	P	H
Nymphaea cv. 'Amabalis'	Water lily	Pink	Lrg	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Arc-en-Ciel'	Water lily	Pink	Med	---	3-4'	Smr	7	P	H
Nymphaea cv. 'Attraction'	Water lily	Red	Lrg	---	3'+	Smr	7	P	H
Nymphaea cv. 'Carmine Ladeker'	Water lily	Pink	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Charlene Strawn'	Water lily	Yellow	Med	---	3-4'	Smr	7	P	H
Nymphaea cv. 'Charles de Meurville'	Water lily	Red	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Colonel A.J. Welch'	Water lily	Red	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Comanche'	Water lily	Change	Med	---	1-3'	Smr	9	P	H
Nymphaea cv. 'Dwarf White'	Water lily	White	Sml	---	1-2'	Smr	9	P	H
Nymphaea cv. 'Escarboucle'	Water lily	Red	Lrg	---	3'+	Smr	9	P	H
Nymphaea cv. 'Faebiola'	Water lily	Pink	Med	---	1-3'	Smr	9	P	H
Nymphaea cv. 'Firecrest'	Water lily	Pink	Lrg	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Flammea'	Water lily	Red	Lrg	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Formosa'	Water lily	Pink	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Frobeli'	Water lily	Red	Sml	---	1-2'	Smr	9	P	H
Nymphaea cv. 'Giant Fragrant'	Water lily	White	Lrg	---	4'+	Smr	9	P	H
Nymphaea cv. 'Gladstone'	Water lily	White	Lrg	---	3'+	Smr	9	P	H
Nymphaea cv. 'Gloire deTemple-sur-lot'	Water lily	Pink	Lrg	---	3'+	Smr	9	P	H
Nymphaea cv. 'Gloriosa'	Water lily	Red	Sml	---	1-2'	Smr	7	P	H
Nymphaea cv. 'Gonnere'	Water lily	White	Dbl	---	3'+	Smr	9	P	H
Nymphaea cv. 'Hal Miller'	Water lily	White	Lrg	---	3'+	Smr	7	P	H
Nymphaea cv. 'Hermine'	Water lily	White	Med	---	1-4'	Smr	9	P	H
Nymphaea cv. 'Hollandia'	Water lily	Pink	Dbl	---	3'+	Smr	9	P	H
Nymphaea cv. 'James Brydon'	Water lily	Red	Med	---	1-4'	Smr	7	P	H
Nymphaea cv. 'Laydekeri Fulgens'	Water lily	Red	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Mansaniello'	Water lily	Pink	Med	---	3'+	Smr	7	P	H
Nymphaea cv. 'Marliac White'	Water lily	White	Sml	---	3-4'	Smr	7	P	H
Nymphaea cv. 'Marliac Flammea'	Water lily	Pink	Med	---	3-4'	Smr	9	P	H

Table 9. Water Gardening, continued. . .

LATIN NAME	COMMON NAME	COLOR	FL	H	SP	BL	S	C	H
Nymphaea cv. 'Marliac Rose'	Water lily	Pink	Med	---	3'+	Smr	9	P	H
Nymphaea cv. 'Marliac Carnea'	Water lily	Pink	Med	---	1-4'	Smr	9	P	H
Nymphaea cv. 'Marliac Chromatella'	Water lily	Yellow	Sml	---	1-4'	Smr	7	P	H
Nymphaea cv. 'Mexicana'	Water lily	Yellow	Sml	---	3'+	Smr	9	P	H
Nymphaea cv. 'Moorei'	Water lily	Yellow	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Norma Gedye'	Water lily	Pink	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Peter Slocum'	Water lily	Pink	Dbl	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Picciola'	Water lily	Pink	Med	---	1-4'	Smr	9	P	H
Nymphaea cv. 'Pink Opal'	Water lily	Pink	Med	---	1-4'	Smr	9	P	H
Nymphaea cv. 'Pink Sensation'	Water lily	Pink	Lrg	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Pygmaea Helvola'	Water lily	Yellow	Min	---	1-2'	Smr	7	P	H
Nymphaea cv. 'Ray Davies'	Water lily	Pink	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Red Ladeker'	Water lily	Red	Sml	---	1-2'	Smr	9	P	H
Nymphaea cv. 'Rose Arey'	Water lily	Pink	Sml	---	1-4'	Smr	9	P	H
Nymphaea cv. 'Rosy Morn'	Water lily	Yellow	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Sioux'	Water lily	Change	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Splendida'	Water lily	Red	Lrg	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Sulphurea grandiflora'	Water lily	Yellow	Sml	---	1-4'	Smr	7	P	H
Nymphaea cv. 'Sultan'	Water lily	Red	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Sumptuosa'	Water lily	Pink	Dbl	---	1-4'	Smr	9	P	H
Nymphaea cv. 'Sunburst'	Water lily	Yellow	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Sunrise'	Water lily	Yellow	Lrg	---	3'+	Smr	9	P	H
Nymphaea cv. 'Texas Dawn'	Water lily	Yellow	Med	---	3-4'	Smr	9	P	H
Nymphaea cv. 'Virginalis'	Water lily	White	Med	---	3'+	Smr	9	P	H
Nymphaea cv. 'Wilfrum Gonnere'	Water lily	Pink	Med	---	3-4'	Smr	9	P	H
Nymphaea tuberosa	Water lily	White	Med	---	3-4'	Smr	9	P	H
Nymphoides crenata var.	Snowflake, Fringed Yell	Yellow	---	---	---	Smr	7	A	T
Nymphoides cristatum	Snowflake, White	White	---	---	---	Smr	7	A	T
Nymphoides geminata	Snowflake, Yellow	Yellow	---	---	---	Smr	7	A	T
Nymphoides indica	Snowflake, Water	White	---	---	---	Smr	7	A	T
Nymphoides indica giganta	Snowflake, Giant Wtr	White	---	---	---	Smr	7	A	T
Peltandra virginica	Water Arum	White	---	24	---	Smr	7	P	T
Pistia stratiotes	Water Lettuce	---	Flt	---	---	Smr	7	A	T
Pontederia cordata	Rush, Prp Pickerel	Purple	---	12	---	Sp,F	7	P	H
Pontederia cordata	Rush, Blue Pickerel	Blue	---	12	---	Sp,F	7	P	H
Pontederia cordata	Rush, Pickerel	Pink	---	12	---	Sp,F	7	P	H
Sagittaria lancifolia	Arrowhead	White	---	24	---	Smr	7	P	H
Salvinia minima	Salvinia	---	Flt	---	---	Smr	5	A	T
Thalia dealbata	Thalia	Blue	---	72	---	Smr	9	A	T
Thalia geniculata	Thalia, Red Stemmed	Violet	---	72	---	Smr	9	A	T
Typha angustifolia	Cattail, Narrow Leaf	Brown	Cat	84	---	Smr	7	P	H
Typha latifolia	Cattail, Common	Brown	Cat	84	---	Smr	7	P	H
Typha minima	Cattail, Dwarf	Brown	Cat	24	---	Smr	7	P	H



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Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens

A Continuation of *The Green Thumb*
Volume 47 Number 2 Autumn/Winter 1990

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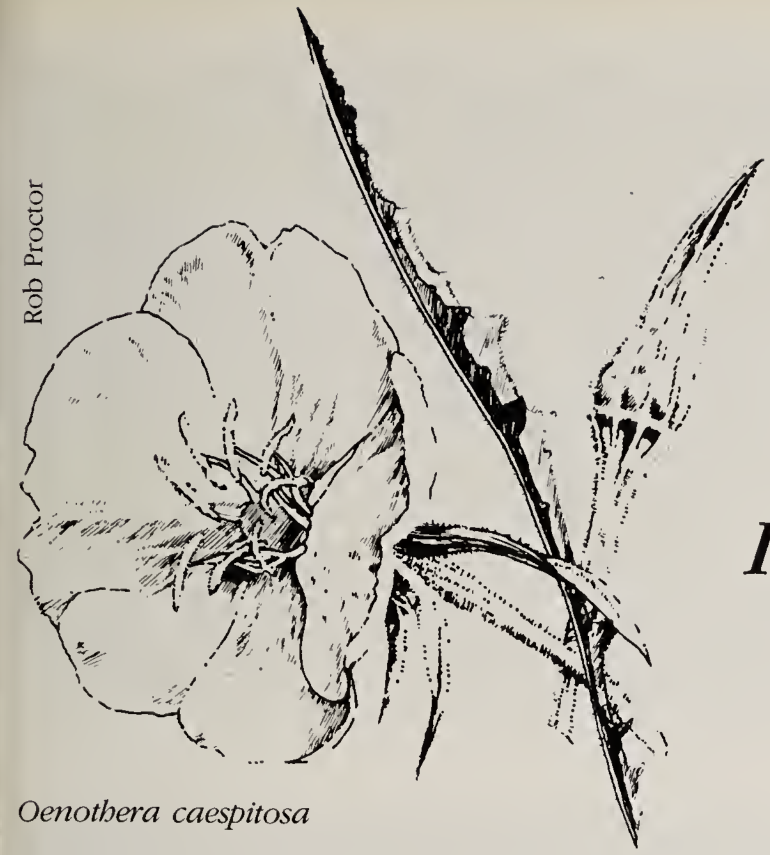


Oenothera caespitosa

Introduction

This issue of *Mountain, Plain and Garden* is devoted to that remarkably diverse group of plants, perennials. Traditionally, the rigorous climate of the Rocky Mountain and Great Plains regions have made gardeners here wary and conservative. In recent years, with the renewed interest in gardening and in herbaceous perennials in particular, horizons have expanded tremendously. Every year new plants are introduced by plantsmen and women, in nurseries, adventurous private gardens, universities, and at botanic gardens.

The most exciting part of all this is the discovery that our climate, for all its daunting extremes, is actually superbly suited for growing one of the most diverse palettes of perennials in the world, from shady woodlanders, to traditional maritime border plants, to the newest, drought-tolerant introductions from the far corners of the world, not to mention the barely-tapped perennial flora native to this region and so full of garden potential.

Perennial plants, strictly defined, have life-cycles that last beyond one season of flower or seed formation, and thus include trees and shrubs. In this issue, however, the term perennial is used in a less scientific, more restricted, and garden-oriented way. Perennials here refer mostly to herbaceous perennials, those that have tops that die down when they go seasonally dormant. Perennials more woody in character that nevertheless are cut to the ground annually by the gardener to maximize their vigor and beauty are also discussed.

One issue can hardly scratch the surface of the huge and quite unexplored subjects of perennials and their uses in design. But here is a start: you will find articles on ever-important soil preparation, Tethyan plants — unusual perennials for the sunny, dry garden, signature perennials ideally suited for this region, plants to stretch the gardening season into the fall, to add shrub-like qualities to the garden, and for low maintenance, as well as perennial gardening at high altitudes. The authors represent a broad base of horticultural expertise, including experts from the green industry, designers and landscape architects, garden writers, and Denver Botanic Gardens staff. Their shared knowledge and advice will give you a taste of the limitless possibilities perennials offer.

The last section, Plant Portraits, is new. Here ten more experts have each chosen and described an under-used perennial of great garden merit. Many of these plants, as well as those mentioned in the articles, are available from local Colorado nurseries. Some may be harder to find; you'll need to look into mail-order sources (the Helen Fowler Library at DBG has an extensive collection of catalogs), or grow them from seed. With perseverance on the hunter's part, and interest on the part of the imaginative people who make up our region's green industry and those who help organize that special horticultural event, the DBG Plant Sale, these perennial plants soon can become an integral part of our exciting, ever-expanding horticultural scene.

Lauren Springer
Guest Editor

Black-eyed susans (*Rudbeckia fulgida* 'Goldsturm') and the pale flower buds of *Sedum* 'Autumn Joy' are a welcome sight in August.

A sunny, richly colored perennial border comes alive in mid-summer.

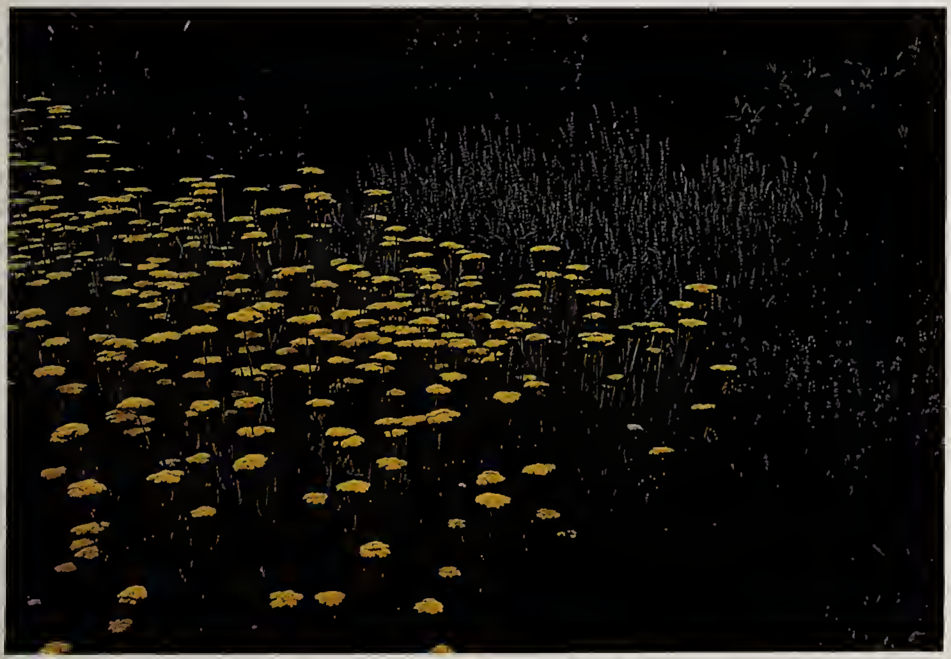
Late summer beauty comes in soft tones and textures with tree mallow (*Lavatera thuringiaca*), Russian sage (*Perovskia sp.*), wormwood (*Artemisia sp.*), and tender Boston daisies (*Argyranthemum frutescens*).

Form, color, and texture harmonize with peonies (*Paeonia lactiflora* 'Toro-No-Maki'), Siberian catmint (*Nepeta sibirica*), and meadow-rue (*Thalictrum minus*).

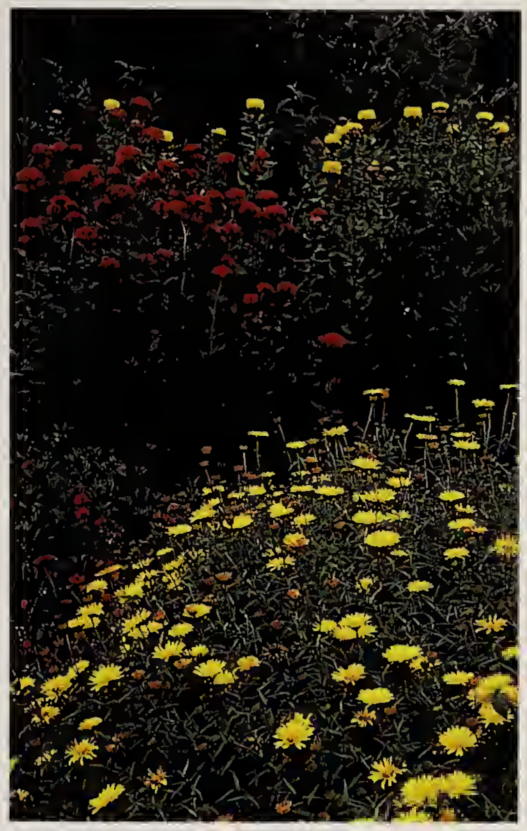
Late spring flowers and foliage grace the DBG Rock Alpine Garden—silver sage (*Salvia argentea*) and rock soapwort (*Saponaria ocymoides*).

In the Tethyan border at DBG, unusual perennials frolic in the heat and dryness of the summer.

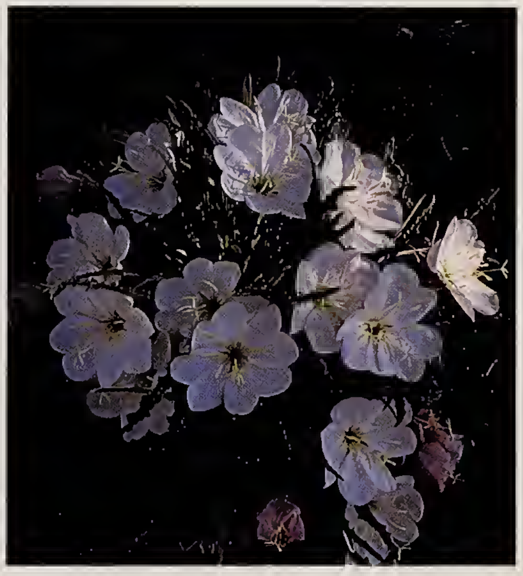
In the shade, hostas create a lush, tropical mood.



Sweeps of yarrow (*Achillea filipendulina*), sage (*Salvia* x *superba*), and lavender (*Lavandula angustifolia*) make a lovely drought-tolerant combination.



Hot-colored yellow knapweed (*Centaurea macrocephala*), Maltese cross (*Lychnis chalcedonica*), and *Inula salicifolia* make a bold statement in the July garden.



White-flowered native evening primrose (*Oenothera caespitosa*) is a long-blooming beauty for the sunny, dry garden.

Signature Plants

by Rob Proctor

Imagine a horticultural game of enormous magnitude: drop participating gardeners (by parachute, we hope) into unnamed cities across the country. Without asking for help, can they identify their locations simply by the plants that grow there? Some cities might be easier than others. Portland is known for its roses, New Orleans for walls covered by bougainvillea, Washington D. C. for its cherry trees, Atlanta for its peaches. Other cities and regions take pride in other plants that have come to exemplify those communities. Particular flowers, where they thrive, symbolize the heritage and lifestyle of the people who live there.

Continue the game by dropping the players in Denver, Colorado, or any of the cities along the Front Range. What will they make of the state of horticulture they find, and will it lead them to the conclusion that they have, indeed, landed in Colorado? Poodle-cut junipers may throw them off — is this a French province, perchance? They'll see more petunias and geraniums than they could have imagined — no help there.

If they happen upon the best areas in the region, they'll find an impressive array or perennials from the four corners of the world. Unless our players have cheated by looking west and spotted the mountains, they might well be confused — where the heck are they? Colorado boasts some world-class gardens that have drawn on many horticultural influences. Some incorporate native plants; others do not.

It is not an accurate measure of the greatness of a garden to judge it strictly by the quantity of native plants it contains. To do so in Colorado is to overlook the gardening heritage of the region, and to ignore the tremendous inventiveness of its gardeners. Many elements have affected our state since pioneers first began in earnest to settle here. Just as our cultural heritage reflects so many influences, so, too, does our horticulture. Gardeners here enjoy a unique position. We are able to grow many plants from other regions of the country — perhaps not always to perfection, but satisfactorily nonetheless. Woodland wild flowers from New England grace some gardens, while desert succulents of the Southwest thrive in others. Traditional perennials from England have made their way here, and exciting introductions from exotic locales around the world take hold here. Combine this with a rich native flora from the mountains and plains, and the gardener is staggered by an incredible diversity of options.

Why then do we see so little imagination in so many gardens? Why do two of the most labor-intensive plants, the "poodle" bush and Kentucky blue grass, find such favor? Perhaps after all the clipping and mowing, the average homeowner is too exhausted to pursue anything more than a cold beer and a few annuals to line the walk. Or perhaps it is suspicion — we sometimes fear what we do not know, and some of us worry too much what our neighbors would think if we plowed up our acreage of lawn to plant perennials. Money is a consideration as well — perennials grown in gallon containers cost four or five dollars, and when planted in the wrong spot, they die (whereas a juniper bush is a fairly safe investment, for it will grow like mad until it blocks all light entering the living room, at which point it can receive a poodle cut).

Nothing I can say will ever make much difference, but good perennial plantings teach by example. I learn from every garden I see, regardless of the level of skill of the gardener, and good examples are to be seen in every neighborhood in every Colorado community. I've been studying them for several years — there is nothing more exciting (or humbling) than to visit a beautiful garden. In doing so, a handful of perennials have caught my attention as plants that might serve as "signature" plants of this area. Some are native plants, while others are exotics that have adapted well to this climate.

The real advantage for the gardener is to be able to draw on so many sources of inspiration. Our close association with the Midwest is one of the most notable, with the all-American style that has evolved there. The East Coast has strongly influenced our choices, though we must compensate with more water to grow those regional plants, while the same goes for perennials from

Great Britain. Mediterranean plants flourish in our abundant sunshine and dry heat; so do the plants of the Southwest. Perennials from the Orient play an important role. Most recently, new introductions from South Africa and Eurasia have entered the Colorado garden scene.

The largest group of perennials that might be characterized as signature plants of our region are those of the *Compositae*, the daisy tribe. The family is a large one, but the best known is the Shasta daisy. It is a persnickity grower, however, sometimes dying out for no good reason, and the blossoms often end up in a soggy mess on the ground. The wild ox-eye daisy, *Chrysanthemum leucanthemum*, offers a longer season of bloom with less tendency for the flowers to flop. Native to Europe, the ox-eye daisy has become naturalized in many countries. It seems perfectly at home here, complementing our native wild flowers without overwhelming them. Flowers bloom on twenty-inch stems for a good part of the spring and summer if spent ones are removed periodically. Though *C. leucanthemum*, too, is a short-lived perennial, it is likely to seed itself.

The many species and varieties of *Coreopsis* enhance perennial plantings. Unfortunately, the plant has been stuck with the common name "tickseed" due to the supposed resemblance of the seeds to that pest. (I've never paid much attention to the shape of the seeds — "gorillaseed" would be more apt to grab my attention — but I've wondered how many gardeners decided to forego planting tickseed for fear of an outbreak of Rocky Mountain spotted fever in their neighborhood.) *Coreopsis lanceolata* has been hybridized into many smaller and double-flowered types, though the original wild species is quite attractive in itself. The golden-yellow flowers are prolifically produced and are a fitting counterpart to the blue Colorado skies. *Coreopsis verticillata* also produces abundant flowers throughout the season. The original species grows to about twenty inches, and the fine-textured foliage is topped by small, single flowers. The cultivar 'Moonbeam' is highly praised for good reason; the pale yellow blossoms cover the foot-tall plants with little encouragement from June until frost. The color is invaluable in most every scheme imaginable. *Coreopsis rosea* is just starting to gain a toe-hold in area gardens, where it has a promising future. Though it closely resembles 'Moonbeam,' its flowers are pink. It is not as drought-tolerant as the rest, so it is a candidate for stiffer loam soils.

Another pink composite, *Echinacea purpurea*, is a bold and stately plant. Though commonly called purple coneflower, the flower petals would be better described as wine-pink. Bristly centers of orange are distinctive even after the petals have fallen. I've often admired these seed heads poking through snowdrifts.

Though the color seems to put some gardeners on the defensive, it is difficult to deny Indian blanket, *Gaillardia aristata.* I'm a bit put off myself by those who call it blanket flower and ignore the "Indian"part. It was for the bold two-tone red and gold pattern of the zig-zag petals that it was originally compared to the bright saddle blankets of the Indians. *Gaillardia* has a distinctly western mystique — a beautiful treasure of the prairie. New cultivars are impressive; 'Goblin' is short-stemmed, growing to a little over a foot, and 'Burgundy' grows to the normal two foot height, but the flowers are deep, rich red. It is stunning planted with rue (*Ruta graveolens*) and silver clary (*Salvia argentea*). Indian blanket requires little attention except for dead-heading, and thrives on heat and drought.

There are so many species of *Penstemon* that they are too numerous to list. They have found little favor outside the western states because most penstemons resent other regions' humidity and heavy rainfall. While we sometimes lament the lack of enough rainfall to satisfy a few thirsty woodlanders, this glorious genus erases all longings for primulas and hepaticas when they burst into bloom. *P. pinifolius* is sometimes called "prairie fire," and the folk name describes it well. The ten-inch stems burn with brilliant scarlet, tubular flowers. Rocky Mountain penstemon, *P. strictus,* boasts two-foot spikes cloaked in blossoms of rich violet-blue. Scarlet bugler, *P. barbatus*, blooms profusely through the summer heat. The red blossoms have a coral cast and the long flowering stems are graceful and elegant.

Blue flax, *Linum perenne*, is a European import that grows as naturally in our state as if it had evolved here. I know a formal garden that is situated with a view of a meadow below, framed by pines and junipers. *L. perenne* has been introduced into the field and allowed to seed itself; on a sunny morning its haze of pale blue flowers steals the show from the carefully tended plants above. The yellow counterpart of the blue species is *L. flavum*, a shorter and less airy perennial with butter-yellow blossoms.

Mediterranean herbs and perennials are frequently seen in our gardens. Grey and green-leaved species of *Santolina* can be clipped into low hedges or allowed to form spreading mounds that are studded with button-like yellow flowers. Thymes, lavender, and dianthus often are used for edging or for the front of traditional borders. Tight purple spires of *Salvia* x *superba* punctuate many a summer garden, and other species grow beautifully here. *Perovskia atriplicifolia* belongs to an allied genus and is called Russian sage. The handsome, silver foliage is topped by spikes of tiny lavender-blue flowers. It is a stately perennial, growing to four feet, and though it certainly would not have thrived in the political climate of the McCarthy era, today Russian sage is a welcome foreigner in a surprising number of area plantings.

From South Africa come the ice plants, and yellow-flowered *Delosperma nubigenum* (syn. *D. congestum*) and magenta-flowered *D. cooperi* grow here like nowhere else on earth — save their homeland, of course. Since their introduction by the DBG Rock Alpine Garden in 1980 and 1985 respectively, these ice plants have become nearly as common as daisies. These little succulents enhance rock gardens, borders, and dryland gardens with their cheerful flowers that open in the bright sun. Other species of *Delosperma* are on trial at DBG and will likely become popular.

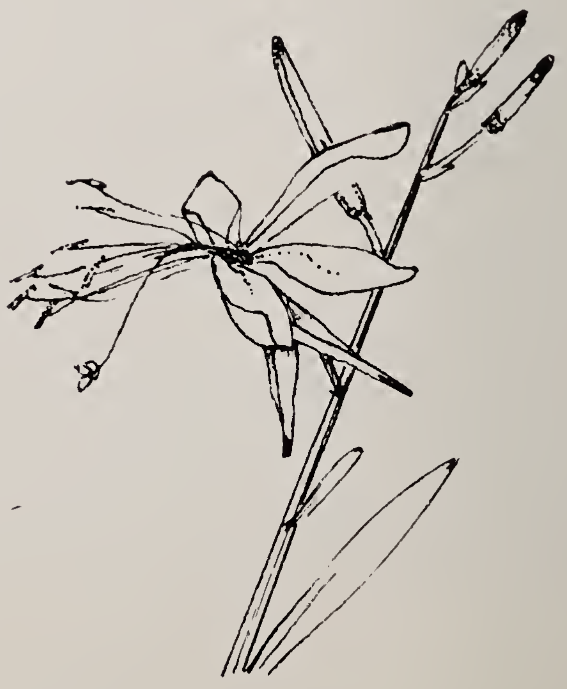
Yuccas have begun to be appreciated in this country, though they were ignored for years, even though the Europeans took great pains (probably pruning too close to the pointed needles) to grow them and extol their virtues. Colorado native *Y. glauca*, is too often paired with a wagon wheel at the entry drive, but it is a dramatic element when planted in irregular drifts with prairie fire penstemon and silver lamb's ears (*Stachys byzantina*). Adam's needle, *Y. filamentosa*, sports showy white flowers. Both yuccas bear interesting seed pods and their architectural, evergreen foliage is highly underrated.

Columbines (*Aquilegia*) are the quintessential flowers of regional gardens, though hot summers often end their blooming period prematurely. It is nearly cause for deportation from the state not to include them in the garden where they can revel in rich, moist soil protected from hot afternoon sun. Another mountain flower, *Heracleum sphondylium,* has yet to make an impact in area gardens, though it is a magnificent plant of ornamental and architectural interest. Known as cow parsnip or cartwheel flower, its thick stems rise above large, coarse leaves to four or five feet. Huge umbels of white flowers crown the leaves, something like Queen Anne's lace with a glandular problem. The seed heads are dramatic even after the flowers fade. *H. sphondylium* thrives along stream banks in its mountain habitat, but performs well (at the back) in a traditional border.

What a lovely punctuation mark to a signature planting is made by species of *Liatris.* The spikes of lavender-purple flowers open from the top down, a feat nearly unequaled in the floral kingdom, where most flowers follow the reverse habit. These unusual flowers grace gardens in mid-to-late summer when most of us could use some invigoration.

So many perennials of the plains offer colorful options for personal statements and combinations. The color of sulphur flower, *Eriogonum umbellatum*, is aptly described by its common name. The name "wine cup" also suits *Callirhoe involucrata*. Most of the evening primroses, species of the genus *Oenothera*, belie their name by blooming by day. The best known is Ozark sundrop, *O. missouriensis*, which glows with prolific lemon-yellow flowers. The night-blooming *O. biennis* is naturalized near old homesteads and in mountain gold-mining towns. *O. caespitosa* blooms with dramatic cup-shaped flowers of pristine white, and *O. speciosa* covers itself with lovely pink-tinted blossoms. The evening primroses possess the fragile beauty of wild flowers but bloom with the determination of petunias.

Gaura lindheimeri has no common name to my knowledge, so I'll propose "apple blossom grass," for the small white flowers are blushed



Angela Overy

Gaura lindheimeri

with pink and exude the translucent, ethereal quality of apple blossoms. They are borne on wiry stems held like wands over the narrow olive-green leaves. The plant blooms from June until frost, and is among the most elegant of the signature plants. It is rather rare in commerce, though a local nursery offered it last summer — blooming madly in gallon containers — and it sold like hotcakes. *G. lindheimeri* seeds itself prolifically when planted in sunny, well-drained sites, so its offspring will no doubt be shared among friends and become local favorites.

Coral bells, *Heuchera sanguinea*, is an all-American native that has long been a cottage garden favorite. It seems to grow in Colorado like nowhere else, and performs well in a number of situations from sunny to shady. If it is planted in optimal conditions in partial shade, it will bloom most of the summer. The white-flowered and pastel hybrids are useful in beds where brighter flowers of the species are not appropriate.

Not all of these perennials will thrive in every garden, but when situated properly, they will perform admirably. Their use in the garden may help define our horticultural traditions as well as our commitment to the future. These perennials serve to give this region a unique feel, not a rubber-stamp copy of any other. As water becomes an ever more valuable resource, they may replace thirsty lawns and commercial plantings designed by out-of-state landscapers with no knowledge of our climate. I continue to be infuriated by vast areas of blue grass turf (in berms, yet) installed where nobody will ever set foot, or water-guzzling flowers planted en masse at new shopping centers and median strips. I shook my head at the planting of hundreds of astilbes I saw last summer planted in full sun next to a parking lot. Don't misunderstand — I love astilbes growing in shady gardens, but they require gallons of water planted next to acres of asphalt, and they dry up quickly in arid heat.

I recall a story a local nurseryman told me of an out-of-town landscape architect who was designing for a new commercial building. He ordered two thousand pots of lily turf, *Liriope platyphylla*, for the project. Lily turf is popular in parts of Texas and California for such projects, because the evergreen grassy foliage crowds out weeds and spikes of lavender flowers bloom in the summer. Unfortunately, *Liriope* is not reliably hardy in Colorado — I know of a few protected gardens where it sneaks through the winter — but when told this by the nurseryman, the out-of-towner said fine, he'd have it shipped in, and stormed out. I haven't a clue what happened to this doomed venture, though I suspect the grounds now feature acres of bindweed.

Even had lily turf been hardy here, would there be any point in planting it? Would our cities be enriched by copying Texas or California? When discussing the merits of a garden or planting, a question that should be asked is, "Is there any **There** there?" In other words, can the observer (our participants in the game — remember them?) tell where they are? Does a garden reflect the sensibilities of the region and complement the natural landscape? Do the colors, textures, and choice of plants impart any sense of place?

Once again, this is not an indictment of any style of garden that seeks to create a feeling of another culture or region. Shaded inner-city homes, by virtue of their age and architecture, are more likely to be surrounded by gardens with strong traditional, perhaps even formal, influences. Inclusion of appropriate signature plants in any area garden regardless of its approach, however, adds a unique touch.

In truth, we have barely begun to scratch the surface of what can be successfully grown here and what may become important signature plants (and we're not going to get much deeper unless we're willing to devote less space to socially-correct impatiens and vinca). There is no such thing as a bad plant — though I've cussed a few in my day — only dull and unimaginative uses and misuses. Well-chosen signature perennials, even in limited numbers, can transform a mediocre garden in short order. The character of perennials is so broad as to offer, literally, something for everyone. Every horticultural effort, no matter how different from one's own taste, should be applauded and encouraged, especially when the gardener displays the courage of his or her convictions. (There are, of course, some astroturf-and-lava-rock-people out there, but they are, most likely, victims of unhappy childhoods, and they should be discussed in a different forum, such as *Psychology Today*.)

The perennials I've highlighted as indicative of our regional horticulture (and there are other plants, especially trees and shrubs) signify the special quality of our gardens and the beauty of the natural landscape. They evoke the grandeur of the plains, the mystery of the mountains, and the dramatic palette of color with which nature painted the land. Most of all, they reflect the spirit of the people who call Colorado home.

Rob Proctor is the author of *Antique Flowers: Perennials* (Harper and Row, 1990) and the forthcoming *Antique Flowers: Annuals* (Harper and Row, 1991.) He combines his love for gardening with his botanic drawing; he writes and illustrates for many publications, including *The Denver Post* column "Front Range Gardeners."

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The Tethyan Garden

by Panayoti Kelaidis

In an age when information and materials can be transmitted around the globe in a matter of moments, it is hard to imagine the early pioneers including a few potted fruit trees and even flowers on the first treks into the West. As they moved their wheelbarrows and wagons farther and farther into drier and more desolate regions, more and more possessions were discarded. Early accounts describe the Oregon trail littered with chests of drawers, sets of china, excess clothing, and other nonessential possessions of the naive pioneers. No doubt, many of their potted plants perished. Those that survived were among the most treasured trophies of the trip, and these form the core of our Western garden-plant palette.

It's ironic that the shrub roses, lilacs, and old-fashioned perennials that were first planted in the new land to remind the settlers of the Midwest were usually natives of Europe or Asia. They had changed many hands and generations from the time they were first domesticated, traveling progressively westward in the process. To this day, only a fraction of the plants sold in Western nurseries are Western natives. Many plants being sold, however, do have a good deal of tolerance for drought, heat, and cold bred into them simply by surviving the trip, not to mention surviving over time in the Western landscape.

The perennial "boom"

Over the last ten years, there has been a great resurgence of interest in traditional garden plants, particularly herbaceous perennials.

Peonies, daylilies, daisies of all sorts, and the whole range of flowering trees and shrubs are joining in to liven up the dull and uniform look of turf- and conifer-planted suburbia. In the water-conscious Western states, this movement sometimes hybridizes with xeriscape: creative gardeners attempt water-thrifty flower borders to replace the endless expanses of green.

I have always had an interest in sensible, water-wise gardens. High mountain ranges of the world catch the moisture borne by prevailing winds, producing rain shadows, or dry areas, on the leeward side. These areas are home to a great many vigorous, heat-tolerant perennials useful for covering ground around the periphery of the Rock Alpine Garden. I aim to select heat- and drought-tolerant plants since this garden is fully exposed to the sun and wind. Water systems invariably break down during long vacations and hot spells, so plants that can endure or even thrive on neglect are always preferable. After a number of years, I noticed that plants able to thrive during the hottest weather share many similarities. Most are silvery or grey of leaf. They often have thick, attractive foliage that holds up well in the hot sun and worst summer weather. Their flowering season tends to last longer, and they can be planted with impunity during the hottest spells.

Again and again I have observed that the perennials that perform best in Colorado gardens tend to be members of the same group of families: the Composites are particularly numerous, as are plants in the Figwort, Mint, Cress, Pea, and Borage families. These families include some of the showiest native plants in the American Southwest. They also include the largest groups of plants that occur throughout the Mediterranean Basin, and Western and Central Asia where our Western American climate finds its closest parallel in temperatures and moisture regimes. Thousands of wild flowers occur in the cold, dry steppes of Eurasia, and only a fraction of these have ever been grown, tested or observed for their potential as ornamental plants in our region.

Why not create a garden where a representative sample of these could be tested? And why not test them so they can resemble a real perennial border, with artistic coordination by size and color? In the autumn of 1986, the first seeds were ordered for a delightful experiment I have come to call the Tethyan border, for reasons I will explain later. An east-facing strip 90 feet long, across from the Hildreth Garden pool at DBG, was selected where only temporary displays had been featured in the past. The soil there probably had been amended years before, and was left as is, a deep clay loam. When there is a shortage of rain, the garden receives about an inch of water by overhead irrigation every two weeks or so. No mulch has been applied, and we take great care not to step on the soil, which is easily compacted. The Mediterranean flavor of this garden might be enhanced by an informal planting of Mediterranean and Western Asian wild flowers.

The Daisy Family (Compositae)

Various daisies are characteristic of and so abundant throughout the Rocky Mountains that one eminent Englishman has recommended the range be renamed the Daisy Chain. Some groups of daisies that occur in Colorado, like the yarrows, pussytoes, and fleabanes, are identical to species found throughout the mountains of the Northern Hemisphere. The yarrow selected for this border is the almost succulent, ever-silver Greek yarrow (*Achillea ageratifolia*) from the Balkan peninsula. This is offered by a number of nurseries in the Denver area, although it is rather uncommon elsewhere around the country. The flowers are larger and more daisy-like than other yarrows, on stems only five or six inches high. The thick mat of foliage, present at all times of the year, makes this plant an ideal small-scale ground cover.

Like the achilleas, hawkweeds are exceptionally well-represented in the Old World. The woolly hawkweed (*Hieracium lanatum*) unfortunately is not evergreen. Nevertheless, its principal appeal is also its leaves, which are oval and similar in size and whiteness to a sand dollar. It produces a constant succession of foot-high stems with soft yellow dandelions just pretty enough to let be. This may not sound irresistible, but everyone who sees those velvety white leaves wants the plant.

The genus *Helichrysum* (sometimes known as curry plants due to their spicy, characteristic aroma) is distributed primarily in the Southern Hemisphere. A secondary center of distribution occurs in the Mediterranean. One of the best-known species of curry plants is the Virgin's plant, *Helichrysum virgineum,* from a few islands and the Athos Peninsula of Greece. The wide, plush cushions of bluish-white leaves are appealing, and the everlasting flowers are attractive both in pink bud and when they open their rustling flower clusters.

Virtually every weed has a glamorous cousin that may even be a challenge to grow. This is certainly true of knapweeds, which have become serious pests on our highways, but plants like the pinecone bachelor's button (*Centaurea conifera* or *Leuzea conifera*) are never quite common enough. This rare Spaniard produces a basal rosette of jagged foliage that is certainly attractive in its own right. The real show begins in July with huge, pinecone-like buds with overlapping silvery scales. The flower itself is a small tuft of blue that lasts only a few days, while the huge handball-size seedhead, now resembling an artichoke, keeps expanding. In August, the pinecone suddenly opens to release the fluffy seedheads. The involucre is just as beautiful after flowering or when releasing its seeds as most plants are in the peak of flower. This delightful plant attracts a great deal of interest throughout the long summer months.

Centaurea bella is found at the other end of the Mediterranean, around the Black Sea. The jagged leaves have an interesting two-toned color. They form a neat mat, with large pink bachelor's buttons produced on foot-tall stalks for most of the month of June. This is a fine edging plant with ground cover potential. In recent years, it has appeared in several local nurseries.

The Figwort Family (Scrophulariaceae)

In the Rockies, few spectacles impress visitors more than the vast fields of penstemons and paintbrushes that color the high mountains blue, scarlet, pink, and purple for much of the summer season. Both genera (*Penstemon, Castilleja*) are practically restricted to Western North America, and both are in the Figwort family. In Eurasia, two large, abundant genera of Figworts are the foxgloves and mulleins. Both are mainstays of traditional gardens, and yet, aside from the common purple foxglove (*Digitalis purpurea*), most *Digitalis* are sun-loving, drought-tolerant Mediterraneans that thrive in Colorado.

Three species are incorporated into this border so far. A tall form of the giant yellow foxglove (*Digitalis grandiflora*), discovered by Jim and Jenny Archibald, the premier collectors of unusual alpine and perennial seed in the wild, was found in Southern Europe. Here in Denver, it stands at the back of the border. This form not only has larger flowers than do the forms in cultivation locally, it also is a more vibrant yellow. This fine plant is a vigorous, long-lived, long-blooming perennial for the Colorado garden that seems to tolerate almost any soil or sun exposure.

Seed of the rusty foxglove (*Digitalis ferruginea*) was also collected by the Archibalds in Greece. This species resembles the better-known woolly foxglove (*Digitalis lanata*), only the stems are even taller—commonly passing four feet in height—and the pouchy flowers are stained deep orange-brown. From a distance, this plant makes little impact, but up close it is strangely alluring. Thus far, three mulleins have been incorporated into the garden. *Verbascum olympicum* grows up to ten feet in height, and a grouping looms over the back of the border like a benevolent bevy of giants. Through the summer, the modestly branching inflorescences produce an almost constant succession of yellow flowers resembling butterflies. *Verbascum bombyciferum* is an outstanding foliage plant, growing a huge rosette of felted white foliage like a tobacco plant in ermine. The flower stalk is just as woolly, shorter than the previous species and more interesting than pretty. Even out of bloom, the gaunt flower stalk holds a sort of cactoid fascination, like an anorexic saguaro.

Verbascum densiflorum has the same fascinating rosettes, felted with tan indumentum. Here the flowering stems are finely branched into an intricate mesh of tiny yellow flowers. The weedy tendencies of common mullein (*Verbascum thapsus*) have frightened many gardeners away from the dozens of stately wild mulleins of the Mediterranean Basin.

The Mint Family (Labiatae)

No family is more characteristic of the Mediterranean than the mints. Anyone who has traveled in Spain or Greece in the summer will remember the rich aroma that hangs over the countryside, imparted by thymes, lavenders, and innumerable other mints. Most people associate the mint family with herb gardens, but many garden perennials belong here, too. A number of unusual species of creeping thyme are used as edgings in this garden, but the real treasures of this family lie in the genera *Salvia* and *Stachys.*

Clary sage (*Salvia sclarea*) is an important medicinal herb, and its essential oil is valuable in a number of industries including perfume and tobacco. There are two little-known variants of traditional garden clary: the variety *turkestanica* appears to be reliably perennial. It blooms in late June and early July, and is generally a yard in height at most. The Archibalds noted a clary of special size and brilliance in Anatolia, and collected seed. They call this "Super clary," since it grows six feet tall or more and has bracts of especially luminous purple. It has a remarkably protracted bloom season extending through July and much of August. It is biennial, but produces such a bounty of seed that its future in cultivation is assured.

Numerous variations on the common European meadow sage occur throughout Eurasia. *Salvia pratensis* itself has paler and brighter color forms, and there are giant cousins such as *Salvia haematocalyx* that are sometimes submerged into the common species. A number of spire-like meadow sages are dispersed through this border for their long season of bloom and bright blue or purple flowers. *Salvia hypargeia,* another Archibald introduction from Turkey, has luminous lavender spires in June. Its large flowers are enhanced by woolly, white, strap-shaped leaves that make it attractive even when it's not blooming.

The most famous foliage plant in the genus is silver sage (*Salvia argentea*). It was purposefully omitted from the border because of its floppy flowers, but several close relatives are here. *Salvia microstegia* has leaves only slightly less silver than *S. argentea*; its flower stems are sturdy, upright, and up to five feet in height. The white flowers glisten through much of June. This has proven itself a reliably perennial background plant for the border.

Two dwarf silver sages are just as woolly as their better-known cousin. *Salvia candidissima* is rarely more than a foot in height in full bloom. Its leaves have shiny white, adpressed hairs, and are attractive through the entire growing season. They have ragged leaf margins that distinguish even the smallest seedlings from the other silver sages. It is the earliest salvia to bloom in Colorado, starting as early as April most years. It is a fine addition to the front of the border. *Salvia frigida* blooms a few weeks later, with congested clusters of lavender flowers on 8" stems. The neat foliage rosettes are gray rather than silver, but pleasing in a quiet, reserved way.

The Archibalds have made a point of seeking out some of the more obscure Turkish salvias, and many years will be required to evaluate all of their collections. From my observations, two of their introductions seem to have unquestionable merit as garden plants. *Salvia cyanescens* may be one of the smallest-flowered salvias, but the blooms are produced in such numbers, and are such a lively tone of blue-lavender that it merits space in all but the most gaudy of borders. Here again the lovely flowers are set off by foliage; this plant's is absolutely gorgeous. The unflowered rosettes have such sleek, silvery white hairs and crisp leaves that they resemble some exotic gesneriad—yes, even *Jankaea,* that impossible cliff plant of Mt. Olympus—while being easily accommodated in any Colorado soil or garden.

Salvia ringens dispenses with subtlety and delicate charms. Here, gigantic two-inch electric blue flowers are flaunted for much of the first half of summer, on five- or six-foot stems. The foliage is attractive as well, a deep blue-green mound of pinnate leaves that are heavily textured like some sort of expensive corduroy fabric.

The variety of salvias in this small garden represents only a small fraction of the wealth contained in the genus. The few representatives of the genus *Stachys* likewise hint of greater wealth that must still exist in the wild. *Stachys* usually calls to mind the common lamb's ear (*Stachys byzantina*), with soft, furry foliage and negligible flowers. It has a number of close relatives with similarly furry foliage, but with much more dramatic bloom: *Stachys germanica* is something of a giant with large pink blossoms over downy white leaves on stems a yard or more high. *Stachys thirkei* is a compact mat-former with fuzzy leaves and deep pink flowers. Possibly the most promising new *Stachys* is *S. inflata,* which forms a shrubby mound rather like a lavender, only with foliage of powdery whiteness. The flowers have baggy calyces, hence the specific epithet, and very attractive large pink trumpets. The most dramatic departure for the genus is *S. alopecuroides* which forms neat green rosettes, and has flowers on 10" stems in a lovely shade of primrose yellow.

As xeriscape and water-conscious gardening gain popularity, so too will the role of the mints in our gardens. Not only are most members of this family drought-resistant, but their bloom season extends for weeks on end in the summer months. Once spent flowers are removed, the foliage is often attractive for much of the remaining year.

The Cress Family (Cruciferae)

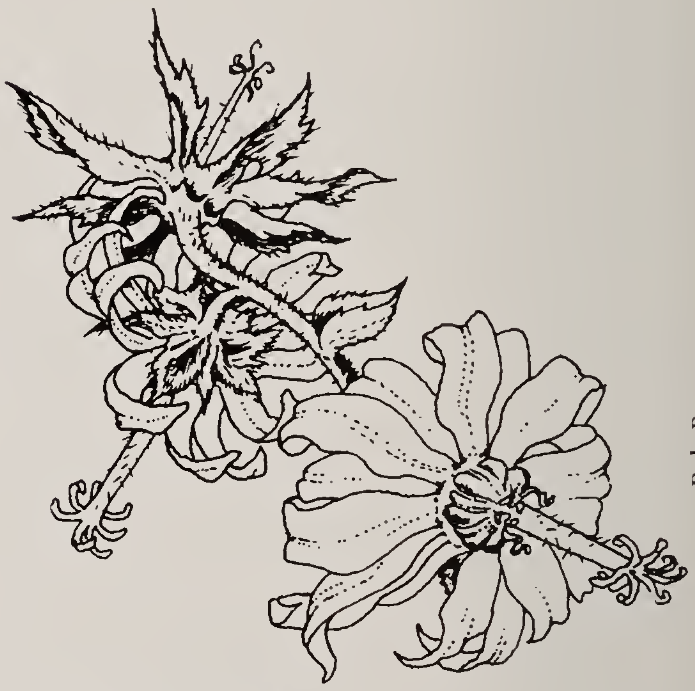
Only a few cresses have been included in this border. *Alyssum montanum* is found over a wide range of elevations and habitats in the Mediterranean. In gardens, it can make long-blooming edging, a rock garden specimen, or a small-scale ground cover. It resembles a prostrate basket-of-gold (*Aurinia saxatilis*), with better foliage that keeps the plant decorative when the flowers are not in evidence. *Barbarea vulgaris* is one of the many universal yellow cresses that have naturalized around the world. The variegated cultivar, however, has a strange attractiveness even when the cheerful yellow flowers are past bloom. It seems to come absolutely true from seed, and therefore makes a much more welcome garden plant than its weedy progenitor.

The Pea Family (Leguminosae)
Astragalus may be the largest genus of showy, temperate climate plants in both Eastern and Western hemispheres. In the garden, unfortunately, more than most other groups of hardy plants, the peas tend to be either temperamental or thoroughly weedy. A single broom (*Cytisus caucasicus*) is slowly establishing itself in the back rank of the garden.

The Euphorbia, Campanula, Poppy and Scabiosa Families (Euphorbiaceae, Campanulaceae, Papaveraceae, Dipsacaceae)
Although euphorbias occur in the New World, they comprise a far less conspicuous element of our natural landscape than they do in Africa and Eurasia. Shrubby euphorbias often dominate hillsides throughout the Mediterranean, and some of these make outstanding garden plants. Two compact, succulent euphorbias from the Eastern Mediterranean make a year-round impact in the border. *Euphorbia rigida* resembles the rather weedy *E. myrsinites* that is often used as a ground cover or xeriscape plant in the Denver area. It is almost twice as tall, however, and far less prone to invasiveness. The flowers are a vivid chartreuse that combines surprisingly well with other colors. *Euphorbia anacampseros* promises to be another fine addition to the local garden scene, for this low succulent, looking like some giant prostrate sedum, has flowers of a deep purple-red in early spring.

A number of campanula species occur throughout North America, but in Western Asia and Southern Europe several hundred species thrive in practically every habitat imaginable. Some of the loveliest of these are considered greenhouse plants in wet climates, but are easily grown under ordinary garden conditions in Colorado. *Campanula incurva* is a relatively localized plant that grows on cliffs in northern Greece. Seed of a particularly attractive ice-blue form was collected by the Archibalds, and it has proven perennial in part shade under the buckeye at the north end of this garden. The large, tubby flowers resemble Canterbury bells, but the silvery, hairy foliage rosette is evergreen, and the entire habit of the plant is very pleasing in a garden setting.

Closely allied to *Campanula,* the genus *Michauxia* commemorates a great French family of botanists who pioneered botanical exploration in both the Eastern Mediterranean and the Southeastern United States. Possibly the most dramatic species in this genus is sure to strike terror in the mouths of most of us: *Michauxia tchihatchewii* is a monocarpic perennial, dying after blooming and setting seed, that forms a large, deep blue-green rosette of toothed, symmetrical leaves its first and second years. If the conditions are perfect, it shoots up a stem a yard or more in height, with more than a dozen pure white flowers, each 3 to 4 inches across. Superficially, it resembles some sort of widely flared, nodding lily far more than a campanula. Blooming as it does for weeks on end in midsummer, this is sure to be a valuable addition to sunny gardens in warm climates.



Rob Proctor

Michauxia tchihatchewii

In the Rockies, the best-known member of the poppy family is prickly poppy, *Argemone platyceras,* although many more species of poppies occur at lower altitudes in the Southwest. Poppies are an important element of the Eurasian steppe flora. The horned poppies are particularly widespread in coastal areas and on sandy deserts of Western Asia. The yellow horned poppy (*Glaucium flavum*) may be the most common in cultivation. It forms a neatly scalloped basal rosette, covered with fuzzy white hairs. The flowering stems rise to a foot or foot and a half, with honey-colored flowers opening daily for weeks in early summer. When the petals drop, the stigma and ovary swell into a long, horn-like seed pod responsible for the common name. It makes for a dramatic specimen in or out of bloom.

The *Scabiosa* family contains a number of genera that form an important component of sunny meadows throughout Eurasia. Particularly striking in large gardens, the genus *Cephalaria* has many giant species with huge, yellow blossoms resembling giant scabiosas. These tolerate a wide range of soils and exposures and make vigorous additions to large borders. Since some species can grow over 8 feet tall, it is important to place them with thought for their ultimate dimensions. *Cephalaria tatarica* grows over a wide range in Central Asia. It is particularly lovely in midsummer when its pale yellow pincushion-like flowers combine elegantly with late-season lavenders and blues.

Combinational themes in the Tethyan Garden

Most perennial gardens are designed for the combinational effect of their flowers. Since so many Mediterranean and Steppe climate plants have substantive foliage that holds up well most of the year, leaf color and texture can become a gratifying way of organizing such a garden. After all, few plants bloom satisfactorily for more than a fraction of the calendar year, but evergreen foliage in our sunny climate is a year-round proposition. Most Tethyan plants have flowers in pastel shades: lavenders and blues, whites, pinks, and primrose yellows. Few of the plants in this garden have flowers with colors that clash against one another, so color coordination is mostly a matter of balancing and combining pastel shades in pleasing ways. The dramatic contrasts of foliage color and shape, as well as plant size, demand greater attention. In order to enhance the illusion of distance, plants with larger flowers and leaves are generally concentrated to the front of the border, while those with finer-textured flowers and leaves are massed to the back. In order to avoid a cluttered feeling, plants with leaves of similar sizes and tints are concentrated together, excepting for plants of particularly dramatic forms and shapes, such as *Michauxia* and *Leuzea* which demand and deserve to stand out from the rest of the pack.

The Sea of Tethys

Like evolution, continental drift seems to be moving from the realm of controversial theory to near-universal acceptance as fact. A generation ago, botanists regarded the prospect of continents drifting about and running into one another as preposterous. As early as the thirties, however, a Soviet botanist named M.G. Popov noted tremendous parallels not only among families, but genera and even species of plants of the American Southwest, the Mediterranean Basin, and Western and Central Asia. He coined the term Tethyan (for the ancient sea that was common to both hemispheres) to characterize the plants common to these regions. He postulated that many of the plants now separated by mountains and oceans derived from common ancestors that, during the Age of Reptiles, grew along the coasts of a vast sea that bordered the region to the south of the area now split into East and Western Hemispheres. Herbaceous plants are notoriously absent from the fossil record. However, whatever their precise origin or genetic relationship in the mists of time, a strong current of commonality unites the floras of the American Southwest and the Eurasian steppes.

Plants from these Tethyan regions have, aside from good aesthetics, a durability, a resilience in the landscape, that puts them in the front ranks of our gardens. Whether they drifted with the continents or traveled on wagon trains to the West, Tethyan plants form the basis of horticulture in semi-arid Continental climates. Come and observe a little-known selection of species from the Eastern Hemisphere of Tethys that are growing in a dryland border here at Denver Botanic Gardens.

Panayoti Kelaidis has been Curator of Denver Botanic Garden's Rock Alpine Garden for ten years. His interests extend far beyond conventional alpines to include native wild flowers and drought-tolerant plants from both Northern and Southern Hemispheres.

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Shari Jones

Gaillardia aristata

Soil Preparation for Perennials

by Virginia M. Weigand

Successful gardeners agree that soil preparation is the secret to a flourishing perennial garden. Proper soil not only provides the plants with nourishment, it also creates an environment for healthy root development and water absorption.

A vast majority of perennials like well-drained soil; standing water will kill most plants by suffocating the roots. Loose, rich, deeply cultivated soil lets excess water drain away and encourages strong root growth.

Rototilling an area can't do the job required for deep cultivation, because a tiller only digs the soil four to six inches deep. Perennials need deeper cultivation; the more area they can use for root growth, the more food and water is available to them. A spade should be used to turn the soil 10 to 12 inches deep. Although this may seem a task, plants respond to such deep cultivation with stronger and more substantial growth.

Don't work the soil when it is very wet because you'll encourage the formation of hard clods. However, the soil should be slightly moist when you spade it; dry soil is difficult to work and erodes easily.

Very poor, hard-to-work soil may require trenching. This procedure ensures deep cultivation and aeration, and offers the opportunity to get additives like organic matter and fertilizer deep down into the soil. Dig a trench along the proposed garden bed, stacking that soil to one side on a tarp or placing it in a wheelbarrow. Then shovel the spaded soil from the next trench into the first area. Continue this to the end of the plot, filling the last trench with soil taken from the first trench.

One of the finest additives for soil is compost. It provides organic matter for soil and acts as a conditioner. Compost is made from leaves, grass clippings, small twigs, vegetable scraps from the kitchen, and garden soil. Composting recycles wastes, thus cutting down on the amount of material hauled to the dump.

Gardeners can make their own compost pile neater and more manageable by piling the composting materials in a wooden bin or a chicken wire enclosure about three feet high and four feet square, placed in a convenient corner. When the lawn is mowed, grass clippings can be dumped into the enclosure. Add leaves, small twigs, and other plant refuse. Layer the material with garden soil to provide the bacteria and other organisms that are needed for the decaying process. The material should be turned occasionally with a spading fork to aerate it, which also speeds up decay, making your compost ready for the garden.

Don't put weeds that have gone to seed, or animal wastes like fat and meat scraps in the compost pile. Weed seeds will come back to haunt you, and animal products can make the compost heap smell, become moldy, and draw flies and other insects.

Compost improves drainage and soil structure, and is a real boon to Rocky Mountain gardeners since soils in this area need organic matter. Within one 50-foot garden plot, soil can vary from being too clayey to being too sandy. Organic matter like compost will improve both these conditions. Don't add sand to clayey soil; it turns the soil into something akin to concrete.

Many brands of commercial compost are on the market, available through garden centers, nurseries, grocery stores and other outlets. Some of these may contain sawdust, wood chips, straw, stemmy plants and other products with very little nutritional value. If you only need to improve your soil's structure, these lower-grade composts are fine, but the best quality commercial compost products are generally those that have been marketed by established companies for many years.

Barnyard manure, peat moss and other organic materials can be expensive and may not be available when needed for the garden. Making compost in the backyard means you have a source of organic matter readily available and at no cost. Compost can be added to the garden anytime, but ideally it's done in the fall.

Before the ground freezes, place two inches of compost on top of the soil. Two to three inches of shredded sphagnum moss also may be added to lighten and aerate the soil even more. Then spade the garden plot deeply, leaving it in large clumps. Don't rake the soil; let the winter snows and the freezing and thawing during the cold months soften it. This will provide the gardener with soil that's easy to rake and till in the spring. If the plot is spaded in the spring when soil is usually at its wettest, clods may result that can't be broken up during the entire summer season.

Fertilizers may need to be added to provide a good growing medium, if your soil is deficient in nutrients. You can supplement your plants' nutritional needs with commercial, synthetic fertilizers or ones from natural sources. Both types of fertilizers are sources of phosphorus, nitrogen, potassium and other elements necessary for optimal plant growth. Barn manure is an excellent additive, as long as it is aged. Fresh manure will burn and destroy plants because of its high ammonia content.

Finally, be patient. Soil conditioning is a continual process. Once the perennial garden is established, of course you won't, and can't spade it every year. This is all the more reason to prepare the soil well at the outset.

Insect and weed control, and normal watering are all that are needed for the perennial garden's first year or two. But perennials spread, usually from side shoots or runners, which causes crowding. Plants can be removed for division and replanting by carefully lifting them with a spading fork. This is also your chance to rework the soil, spading deeply and using additives as suggested above. Then replant the perennials as soon as possible.

As the garden grows, perennial plants will show the effects of good soil. Strong stems, beautiful and abundant blossoms, and a gorgeous, natural effect will repay the gardener for all this work.

Editor's Note: The above describes soil preparation for a perennial garden using traditional garden perennials, most of which require a relatively moist, rich soil. For those seeking to experiment with native and/or xeric (drought-tolerant) plants, you may only want to cultivate the soil and disregard the amendments. These plants survive on, and often demand, an infertile, dry soil.

Virginia M. Weigand, a graduate of Colorado University College of Journalism, gardens in Golden, CO. She wrote a news column for *The Golden Transcript* for forty years; she continues to write a weekly weather column, incorporating garden tips.

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Industrial-Strength Perennials for Home and Office

by Ray Daugherty

My interest in what I call industrial-strength perennials began at an early age, when I first became fascinated by seeds. How could a plant produce a little package that, after being scooped out of a fruit, allowed to dry, and set on a shelf for an extended period, then suddenly burst forth into a strong new plant when put in the garden? This is truly the most basic form of the concept industrial-strength. Later, I learned that many of my favorite plants weren't grown from seeds at all, but from cuttings, which, to my amazement, were actually pieces of plant amputated from the mother plant. My awe of the amount of abuse that plants can not only survive, but even thrive on, continues to this day, and has led me on a quest to find, understand, and cultivate the toughest of the tough, and to help introduce them to gardeners and professionals in the green industry.

Over the last several years I've been happy to notice an increase in the use of perennials, both in large landscapes and in the home garden. At the same time, I've been dismayed at the misunderstandings and mistakes that occur regarding when and how perennials are used in a commercial landscape, as well as how they fit into the smaller, residential garden to help solve those "problem spots." In both these situations, industrial-strength perennials should take center stage.

What exactly is an industrial-strength perennial? First of all, it is an *adaptable* plant. Most perennials that deserve this label (and it is a high honor) will withstand sudden changes in their environment without major damage to their looks or their health, while other less-adaptable plants are curling up and dying. Also, they are usually hardy as well as heat-tolerant. Many can take a good deal of drought, with some able to thrive on only the sparse summer rains of Colorado.

Secondly, industrial-strength perennials are *competitive*. This means that they are big enough to choke out surrounding weeds before the weeds choke them out, or if they are smaller plants, they can maintain themselves well enough to come back vigorously once maintenance is finally provided. This doesn't mean that they have to be invasive. In fact, it is often better that they stay in place so that they meet the last criterion — *low maintenance*.

Ideally, an industrial-strength perennial would, once established, never require further maintenance. Unfortunately, all plants seem to produce some part that becomes ugly if left in place on the plant, be it last year's withered foliage, old flower stalks, unattractive seed heads, or the like. Therefore, a more realistic definition is that an industrial-strength perennial requires only minimal removal of these unattractive parts, preferably once a year in early spring. Also, the plant must not be attacked by insects or disease to the point of disfigurement, and it must be long-lived.

As with annuals, perennials can be used to create summer-long color. This is done by using one particularly long-blooming species, or by combining several with different, yet overlapping bloom times. Threadleaf tickseed (*Coreopsis ver-*

ticillata) and pink tickseed (*Coreopsis rosea*) both work well as single-species mass plantings due to their extended bloom period. Daylilies (*Hemerocallis* hybrids) can be used alone, and still achieve a long season of color, by mixing cultivars that bloom at different times. One excellent daylily combination includes the cultivars 'Pizza,' 'Hyperion,' and 'September Gold,' giving color from early June until frost.

Combined plantings can be very subtle, or vibrating with contrast, depending on the interplay of texture, form, and color. A dynamic grouping for a sunny, dry area might combine showy stonecrop (*Sedum spectabile*), torchlily (*Kniphofia uvaria*), ravenna grass (*Erianthis ravennae*), hardy ice plant (*Delosperma nubigenum*), and pineleaf penstemon (*Penstemon pinifolius*).

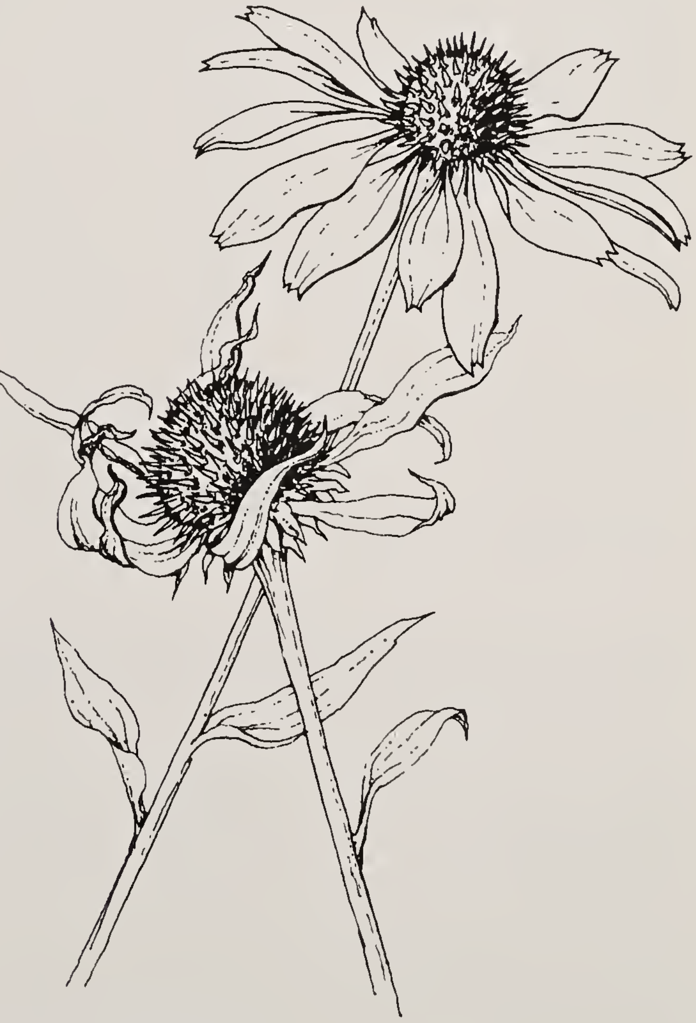
Perennials can be used for more than summer color. By choosing species with evergreen foliage and/or early flowers, you can give a planting color and mass before annuals can be safely planted out and long before they fill in. In a large commercial landscape, perennials can be used near entryways to provide needed interest and color all year long, or in large beds with shrubs and annuals, for added permanence as well as seasonal change.

One major advantage of using perennials properly in a large landscape, as compared with annuals, is to reduce maintenance costs. Industrial-strength perennials, requiring only cutting back and raking in the spring, offer great savings in labor costs compared to annuals, which need yearly soil preparation, planting, establishment, and removal. Some of the lowest maintenance perennials for large, shady landscapes are lily-of-the-valley (*Convallaria majalis*), variegated bishop's weed (*Aegopodium podagraria* 'Variegata'), and plantain lily (*Hosta* species and hybrids). Although some people malign the first two for being weedy, for large plantings where they won't run over other plants, they are my favorites. In sunny locations, threadleaf tickseed, Siberian iris (*Iris sibirica*), butterfly iris (*Iris spuria*), many ornamental grasses, and plume poppy (*Macleaya cordata*) are blessed with good looks that require only a spring mowing to maintain.

In the smaller landscape, industrial-strength perennials can be used in unlimited ways. Larger ones like plume poppy and *Arundo donax* might screen a private patio. Others, like Siberian iris, showy stonecrop, *Yucca sp.*, torchlily, and peonies (*Paeonia sp.*), can make small hedges, create points of interest as specimen groupings, or form the backbone of a perennial border. With characteristic longevity, non-invasiveness, and low maintenance, they form a mature core of plants around which more ephemeral perennials, biennials, and annuals can be planted, and prevent that newly-planted look. Due to their tough constitutions, industrial-strength perennials' most desirable role may be in beautifying those "impossible sites," where conditions are formidable and/or maintenance difficult.

A list follows that contains some of the best industrial-strength perennials. Many are quite common, but I think it's important that we not lose sight of their value simply because John Doe already has them in his garden. Plants should be judged solely on their individual merits. There's often good reason why a plant is popular. I hope that many of the less common industrial-strength perennials will also find their way into the hearts and plantings of homeowner and commercial landscaper alike.

Ray Daugherty received his B.S. in landscape horticulture from Colorado State University. He is the propagator at Green Acres Nursery in Golden, CO, where he focuses on bringing industrial-strength, native, and unusual plants into the trade.


Rob Proctor

Echinacea purpurea

Some Industrial-Strength Perennials

Botanical Name	Month of Bloom	Height	Moisture	Sun	Remarks
Achillea filipendulina vars.	Jun-Aug	2-5'	mod/dry	full	excellent midsummer color
Anemone hupehensis vars.	Aug-Sept	2-4'	mod	sun/shade	bold foliage, late color
Asclepias tuberosa	Jun-Jul	1'	dry	full	comes up late, sandy soil
Ceratostigma plumbaginoides	Aug	1-1/2'	mod/dry	sun/shade	good fall color
Cimicifuga racemosa	Jul	3-5'	mod	partial	excellent with shrubs
simplex	Aug-Sep	3-4'	mod	partial	blooms later
ramosa 'Atropurpurea'	Aug-Sep	3-4'	mod	partial	bronze leaves
Convallaria majalis	May-Jun	6"-1'	mod	shade	will tolerate dense shade
Coreopsis grandiflora	Jun-Sep	1-3'	mod	full	many varieties
verticillata vars.	May-Oct	1-2'	mod/dry	full	excellent in mass
rosea	May-Oct	1-2'	wet	full	best for wet spots
Dictamnus albus vars.	Jun	2-3'	mod	full	long-lived, pink or white flowers
Echinacea purpurea	Jun-Sep	2-4'	mod/dry	sun/shade	striking rose-pink flowers
Eremurus species and hybrids	Jun-Jul	3'	dry	sun	needs good drainage, showy spikes
Euphorbia epithymoides	May	2'	mod	sun	excellent foliage/fall color
Geranium x cantabrigiense	Jun-Sep	8-10"	mod	sun/shade	long-flowering ground cover
x 'Johnson's Blue'	May-Jun	2'	mod	sun/shade	may require cutting back
x oxonianum 'Claridge Druce'	Jun-Aug	1-1/2'	mod	sun/shade	best pink geranium
psilostemon	May-Aug	2'	mod	sun/shade	excellent magenta flowers
Grasses:					
Arundo donax	Sep-Oct	12' plus	wet/dry	sun	use as screen, drought-tolerant
Calamagrostis arund. vars.	Jul-Dec	4-8'	mod	sun	fall and winter interest
Erianthis ravennae	Aug-Dec	6-8'	mod/dry	sun	long-lived, fall and winter interest
Helictotrichon sempervirens	Jul-Sep	2-4'	mod/dry	sun	evergreen blue-grey foliage
Hosta species/varieties	Jul-Sep	8"-3'	mod	shade	long-lived, foliage texture
Ipomoea leptophylla	Jun-Sep	3'	dry	sun	native, willow-like perennial
Iris aril-breds	May	2-3'	dry	sun	interesting colors
x germanica hybrids	May-Jun	2-4'	dry	sun	spectacular flower shower
pumila hybrids	Apr-May	6-12"	dry	sun	profuse early bloom, tough plants
sibirica hybrids	Jun	1-4'	wet/dry	sun	long-lived, excellent foliage
spuria hybrids	Jun-Jul	3-4'	mod or dry	sun	very drought-tolerant
Kniphofia uvaria hybrids	Jun-Oct	4-5'	mod/dry	sun	requires good drainage
Liatris punctata	Jul-Aug	1'	dry	sun	native
Liatris spicata	Jul-Aug	2-3'	dry	sun	showy spikes of purple flowers
Macleaya cordata	Jul-Aug	4-8'	mod/dry	sun	bold foliage, use as screen
Mirabilis multiflora	Jun-Oct	2'	dry	sun	native, won't transplant
Paeonia lactiflora hybrids	May-Jul	to 4'	mod/dry	sun/shade	very long-lived (50+ years)
Paeonia officinalis	May	2'	mod/dry	sun	earlier than P. lactiflora
Polygonum cuspidatum 'Compactum'	Jul-Aug	2-3'	mod/dry	sun	excellent bank cover
Salvia x superba varieties	Jun-Jul	2'	mod	sun	bracts showy after flowers finished
Saponaria ocymoides	May-Jun	1-1/2'	mod/dry	sun	excellent for planted walls
Veronica liwanensis	May	2-6"	mod/dry	partial	fabulous blue flowers, evergreen groundcover
Waldsteinia ternata	Apr-May	6-8"	mod	partial	evergreen, nice ground cover
Yucca baccata	Jun	2-4'	dry	sun	fruit edible, coarse texture
filamentosa	Jun	2-3'	mod/dry	sun	soft leaves, best flowers
glauca	Jun	2-3'	dry	sun	fine leaves
Zinnia grandiflora	Jun-Sep	6"	dry	sun	excellent as mass planting

Shrubs That Can Be Used As Industrial-Strength Perennials

Botanical Name	Month of Bloom	Height	Moisture	Sun	Remarks
Caryopteris incana	Aug-Sep	3-4'	mod/dry	sun	blue flowers, winter texture
Gutierrezia sarothrae	Sep-Oct	1-1/2"	dry	sun	yellow flowers, like dwarf *Chrysothamnus* (rabbitbrush)
Hypericum patulum 'Hidcote'	Jun-Oct	2-3'	mod	partial	huge yellow flowers
Perovskia atriplicifolia	Jul-Aug	3-4'	dry	sun	blue flowers with silver foliage
Vitex agnus-castus	Aug-Sep	4-5'	mod	partial	excellent, late blue flowers

From the Ground Up: Woody Perennials

by Diane Ipsen

When we speak of perennials, most people assume this refers to the long-lived flowering plants of the garden. In this context, perennials mean herbaceous plants whose stems die back to the ground in cold weather while their roots survive. There are woody perennials as well, which include trees, shrubs, and vines whose top growth survives winter without dying.

In Colorado and other cold climates, a number of shrubs are treated like herbaceous perennials in that they are pruned to the ground in early spring, either annually or every few years. This is done for several reasons.

For one, the stems of certain woody plants normally die down to the ground in Colorado winters. Sometimes (but not too poetically) these are called "die-back shrubs." Another reason for pruning certain shrubs to the ground is that they look better if this is done. Compact growth can be restored to a sprawling, leggy shrub, and additionally, cutting back particular shrubs encourages more exuberant flowering.

Do not, however, impose this type of pruning indiscriminately on other shrubs in the garden. The woody plants that are treated like herbaceous perennials all bloom on "first-year wood," the current year's growth, as opposed to shrubs such as lilacs or flowering almonds, whose flower buds are formed the previous year. That is why only the former can be cut to the ground in early spring and still be covered with blossoms in summer.

The following are a few of the woody plants that should be treated as herbaceous perennials in Colorado:

Annabelle Hydrangea (*Hydrangea arborescens* 'Annabelle')
This is a small, easily-grown shrub with large, dark-green leaves and bold, white flower clusters in mid-summer. It performs best when given a moisture-retentive soil in light shade. Though hardy, its top growth sometimes dies back in winter. When this occurs, the stems are cut to four inches or lower in early spring. As with all the shrubs listed here, I recommend cutting back 'Annabelle' hydrangea in spring rather than fall because of the mass and interest it adds to the winter landscape. Hydrangeas, in particular, hold their bronzy, dried flower heads all winter and look attractive in a snowswept garden.

Blue Mist Spirea (*Caryopteris incana, C.* x *clandonensis*)
Although the stems of this popular garden shrub may not always die back in a harsh winter, a more pleasing form and better flower display can be achieved with a severe pruning at least every other year. Without such treatment, the plant becomes open and rangy, getting up to four feet in height. By pruning it to the ground, blue mist spirea is kept suitably small for use in the sunny perennial garden. A haze of blue flowers appears on the new growth in mid to late summer, providing cool contrast to hot colors. The plant is drought-tolerant as well. The tan seed heads of blue mist spirea are handsome in the winter garden, so again, reserve pruning for early spring.

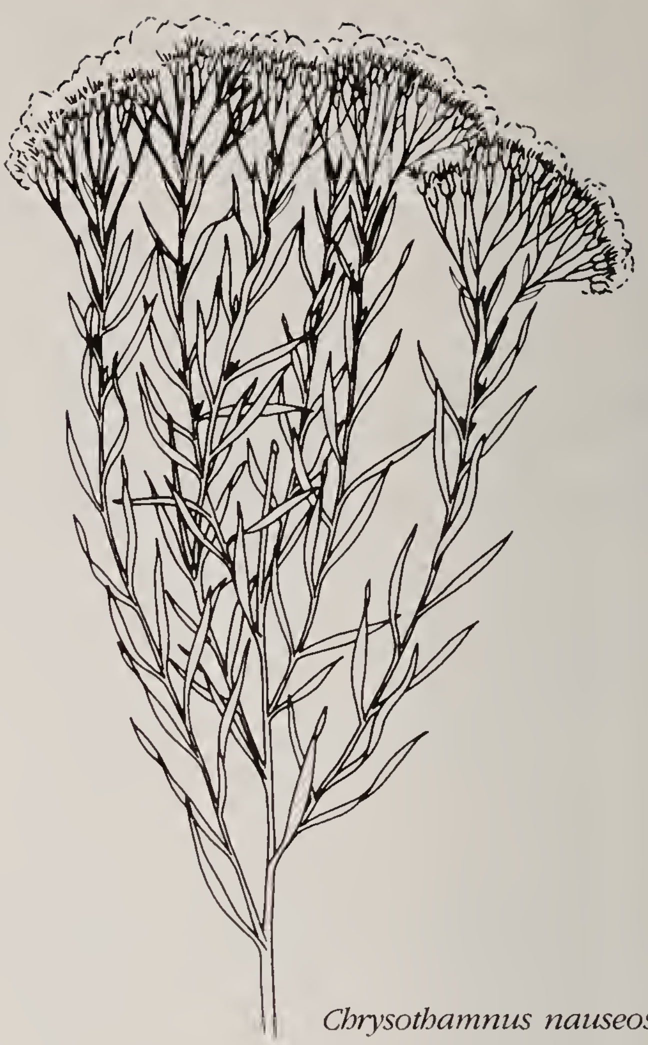
Kelsey Dogwood (*Cornus sericea* 'Kelseyi')
This dwarf, red-stemmed dogwood is another woody plant whose top growth dies entirely during a cold winter. Since the stems turn a more brilliant red when frozen, do not cut them back until spring in order to enjoy the color against the snow. Kelsey dogwood becomes quite leafy and dense in one season, reaching a tidy two feet in height. It needs a moderate amount of moisture.

Potentilla (*Potentilla fruticosa*)
The woody varieties of potentilla thrive on being pruned to the ground periodically. These long-flowering shrubs tend to get squashed by the snow, making them sprawl in an unattractive manner. To correct this habit, potentillas can be cut back every third spring. Because they bloom on the current year's growth, potentillas will produce their yellow, white, apricot, or copper flowers faithfully the same year they are pruned.

Orange-Eye Butterfly Bush (*Buddleia davidii*)
Sometimes called summer lilac in catalogs, this species of butterfly bush behaves like an herbaceous perennial where winters are cold. Even in the South, it is recommended to cut this plant back to six inches before its spring growth begins, since it blooms on current year's wood. For this effort, the gardener is rewarded with a long bloom period: fragrant flower spikes last from summer till fall, attracting butterflies all the while. There are numerous varieties, with flower colors ranging from pink to lavender, purple and white.

Rabbitbrush (*Chrysothamnus nauseosus*)
Apache Plume (*Fallugia paradoxa*)
These two are dryland native shrubs that do not die back, yet benefit from periodically being cut to the ground. Both grow four to six feet in height. After the yellow flower heads of rabbitbrush have bloomed in early fall, they dry to tan and are lovely in the winter landscape. Apache plume's white stems bear single white flowers and dramatic plume-like seed heads simultaneously, creating a unique display. Sometimes, particularly when irrigated, rabbitbrush and Apache plume may grow too open and leggy. This is the time to take them back to the ground. Both plants grow rapidly, and some people recommend cutting them back every spring.

Russian Sage (*Perovskia atriplicifolia*)
Another drought-tolerant plant that one can expect to prune to the ground annually is Russian sage. This handsome plant is classified as a sub-shrub, and it dies back most years in Colorado. Even if it doesn't, flowering and overall strength are bolstered by this treatment. Russian sage grows three to five feet tall in a single season, and is a striking accent plant. Its showy spikes of tubular lavender-blue flowers in mid and late summer are beautiful against its lacy grey-green foliage. Other sub-shrubs which may die back in Colorado include lavender (*Lavandula angustifolia*), and some species of *Hypericum*.


Paula Nichols

Chrysothamnus nauseosus

Tree Mallow (*Lavatera thuringiaca*)
This woody perennial is quite new to American horticulture. At DBG, it has survived undaunted for several years. Its large, clear-pink, mallow-like flowers appear from mid-summer until frost. The variety 'Barnsley' has white flowers with a rose eye. Sun-loving tree mallow offers handsome, sage-green foliage that is unusually lush and large for a drought-tolerant plant. It grows three to five feet tall in one season, and must be pruned to the ground each spring for best effect.

Diane Ipsen holds a master's degree in landscape architecture and her practice focuses on residential design. She emphasizes water-wise landscapes and likes transforming clients into enthusiastic gardeners.

Perennials in the Mountains

by Marty Jones

I first began landscaping in the mountains in 1974. As I learned more about plants, I became frustrated by the lack of varieties recommended for the mountain climate, as well as by the limited offerings of wholesale suppliers, so I started to experiment. In 1985, I found a permanent location for a garden center, and immediately began planting perennials around the nursery wherever I could. This made an attractive and informative display for customers and myself as well. Every year we have added to the garden, and continue to do so. It is the best salesman I have.

However, it wasn't until my involvement in developing the Betty Ford Alpine Gardens that I really had the opportunity to test a wide range of perennials directly under my care and supervision. Here, at an altitude of 8200 feet, these plants have taught me an enormous amount in three short years. I learn more every time I go in the garden.

The main thing I've learned is that the mountain climate is ideal for growing perennials. They thrive on the cool, dry, sunny days and cooler nights, producing firmer, greener foliage, and a more brilliant flower display for a longer period of time. Also, the early, long-lasting snow cover could not be a better mulch. In Vail, it usually snows before the ground freezes, and lasts until late March or early April, changing the climate at ground level drastically. The low air temperature last year was almost minus 25 degrees Fahrenheit, while at soil level, the low was only 5 degrees above zero. This accounts for the success of plants that were thought not to stand a chance here, like *Raoulia australis, Delosperma nubigenum, Euryops acraeus,* heathers (*Erica* and *Calluna* species), barrenworts (*Epimedium spp.* and hybrids), waterlilies, Mexican phlox (*Phlox mesoleuca*), brooms (*Cytisus, Genista* species), and many others.

These exotics aside, the old standby perennials also thrive in high-altitude gardens: lupines (*Lupinus polyphyllus*), *Delphinium* hybrids, shasta daisies (*Chrysanthemum* x *superbum*), irises, lilies, and columbines (*Aquilegia* x *hybrida*), among others. Unfortunately, there are many cultivars of these and other old favorites that are not commonly offered, due to a Catch 22. Garden center and nursery owners and personnel are reluctant to carry plants they aren't familiar with, and the public can't buy a plant that isn't being offered.

Fortunately, there are some solutions to this problem. One is for nurseries to plant substantial demonstration gardens so their customers can see what a mature plant looks like. This is especially important with perennials, since they rarely come close to their full potential while in a small container. Another idea is for interested people, both homeowners and professional plants people, to support and get involved with local botanic gardens. These institutions should be on the cutting edge of horticulture, demonstrating new plants to the public, and making material available to the trade. Then the clamoring begins. A new plant is shown and everyone wants it. Suddenly there are availability problems — there's a demand for a plant that was unknown just last year. Nurseries gear up, and sales are great. Then the novelty wears off, and sales slump, sometimes to the point where good plants are pushed out of production once again, and so goes the cycle.

I've found that displaying plants in a garden setting helps sales grow annually. Once the plants are seen in friends' and neighbors' gardens, interest continues to grow. Most gardeners like diversity, so the better the selection, the better for both the customer and the business.

It is sometimes difficult to obtain desired plants. Searching, patience, and perseverance are the secrets. I've searched for five years just to obtain the seed of some plants, and then had to wait another three or four to have enough to sell. Sometimes it is as easy as attending the Denver Botanic Gardens plant sale in the spring, or looking in the catalog selection at the Helen Fowler Library for a mail order source.

Now, how to grow perennials best. The questions most often asked of me are "What's your secret? How do you grow such vigorous plants? How come mine don't look like this?" There are two answers: first, good soil preparation. We used liberal amounts of peat and well-rotted manure in the soil mix at the Betty Ford Alpine Garden, up to 50% peat and manure, and 50% rich topsoil for the woodland and mixed perennial beds (some of the other beds were leaner, depending on the plants' needs). This not only provides a great medium for plant growth and water retention, it also makes weeding much easier.

The other reason for the beauty and health of our perennials has little to do with human effort. It is the wonderful mountain climate. When people from out of town ask me, "How do you get your plants to look like that?" I tell them to give plenty of sun, night temperatures of 40 degrees, and days not exceeding 85. Add two to four feet of snow in November and don't remove until April. Where else can you provide this recipe but in the glorious Rocky Mountains? So if you're a gardener in the high country, don't despair. Rejoice. A beautiful garden, filled with perennials, is within your grasp.

Marty Jones owns and runs Colorado Alpines, Inc., a mail-order business specializing in rare alpine plants in Vail, CO. This self-taught horticulturist is also garden director of the Betty Ford Alpine Gardens, where he oversees over a thousand different alpines and other perennial plants.

Perennials for Fall

by Lauren Springer

Come fall, green finally bids the leaves farewell, making way for new foliage colors that before only existed in blossoms. Gazes turn to the aspen's glamorous show. Gone are the deep blue delphiniums, foamy gypsophilas, soft pink peonies. Has the perennial garden closed up shop for the season? Not necessarily.

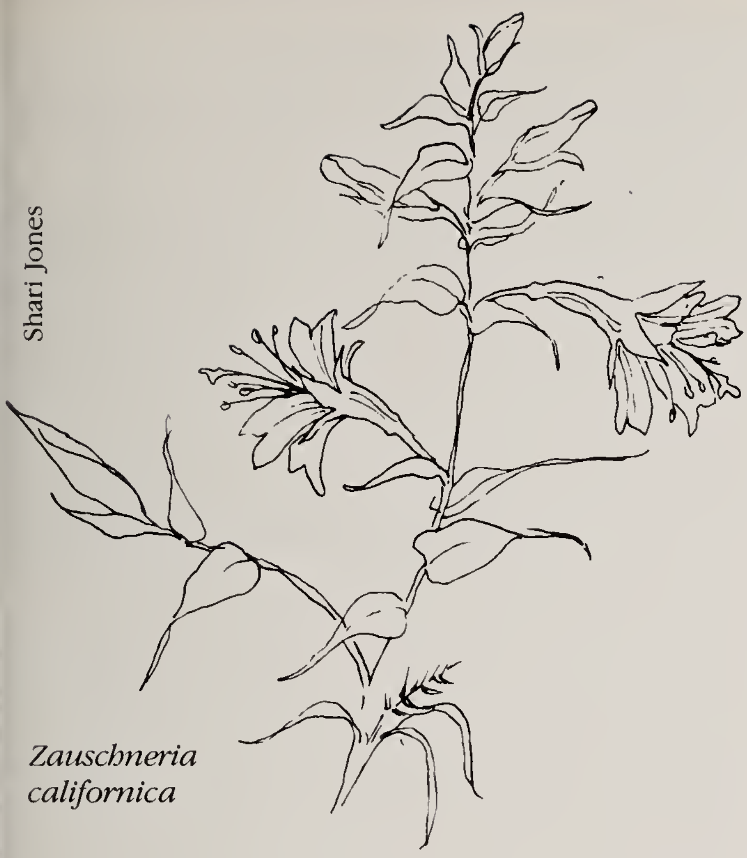
After the seduction by the voluptuous floral display of early summer, gardeners often face the rest of the season with lagging enthusiasm. One look at the changing beauty on the prairies and in the foothills and mountains should cure this. Our rich flora offers inspiring autumnal scenes. Fall is not a wimpering finale; it can be a reprise of early summer, in deeper, earthier, more mature tones.

There's no reason why fall's purple asters, goldenrods, sunflowers, and deep blue mountain gentians can't come together in a garden as the soulmates they are in the wild. Add a smattering of native fall-bloomers from other parts of the country, and a few exotics. Ornamental grasses rustling in the cooler breezes, their panicles and plumes backlit by a mellow autumn sun, help complete a garden picture to bring the growing season to a lovely close. Only the earliest scenes of spring—sweeps of crocus and *Iris reticulata* in still-dormant buffalo grass, wild bluebells (*Mertensia oblongifolia*) and snow lilies (*Erythronium grandiflorum*) found on a soggy, early-spring hike—give me as much pleasure as do those perennials that save their best for last.

Colors are different in the fall. The quality of light changes with the seasons, and as the sun drops lower in the fall sky, the light—unlike the strong, bald sun of early spring and the assertive brightness of summer—becomes a warmer golden-amber. The cooler temperatures intensify the plants' pigments, adding to the richness. Pastels are rare, and the purest colors of the spectrum dominate, deep and smoldering, as if holding summer's heat and sun within their leaves and flowers. The low sun creates dramatic backlit effects in the morning and late afternoon, especially lovely on flowers with delicate petals or the inflorescences of ornamental grasses.

Somehow, in autumn, color combinations that might make your hair stand on end during the spring or summer don't seem to clash. Rather than being an affront to the artistic gardener's finely-tuned color sensibilities, purple asters and magenta colchicums beneath a sumac with red leaves on fire are a welcome sight. A daring gardener might try the soft lavender flowers of *Aster* 'Professor Kippenburg' next to an orange-spiked

Shari Jones



Zauschneria californica

variety of red-hot poker (*Kniphofia triangularis*). For the more faint at heart, cream-yellow *Kniphofia* 'Little Maid' blends well with low-growing, light pink cultivars of New York asters. Deeper yellow kniphofias with the lavender-blue daisies of *Aster* x *frikartii* echo that classic fall color combination of nature—purple and gold.

Even if some of the wilder color combinations aren't for everyone, no autumn garden with a dry, sunny spot should be without at least one of the several wonderful, red-flowered *Zauschneria* species. Blue or grey-leaved, drought-tolerant perennials like rue (*Ruta graveolens*) and partridge feather (*Tanacetum densum var. amani*) add a subtle background to the show-stealing, fiery trumpets of *Zauschneria*.

Asters are probably the genus most deserving of the title harbingers of fall. There are asters from soggy bogs, parched prairies, cool alpine meadows, even the dry shade of pine forests. Aside from the ever-popular *novi-belgi* cultivars, the New York asters, and the lovely, yet ungainly giants, the New England asters (*Aster novae-angliae*), there are many others worthy of more garden space. Two especially good ones that thrive in our climate without an excess of additional moisture are bristle aster (*Aster linariifolius*) and *Aster lateriflorus* 'Horizontalis.' Both are fine-textured and dainty in demeanor, and rarely rise above two feet unless given too much water. Bristle aster is smaller and blooms earlier in fall, with sprays of small, lavender daisies over narrow stems clothed in needle-like foliage.

Later, *Aster lateriflorus* 'Horizontalis' is densely covered in sprays of the tiniest mauve flowers with deep maroon centers, borne on horizontally-branched stems, hence the name. The mauve and maroon colors are echoed in the tiny, purple-tinted leaves. Try it with the late, white flower clusters of pearly everlasting, *Anaphalis margaritacea,* also an American native. This plant's narrow, silvery-grey leaves will add to the subtle combination.

Sedum 'Autumn Joy,' contrary to its name and well-deserved popularity, is actually one of those unbelievably rare finds—a four-season perennial. In the spring, Brussels sprout-like shoots poke through the ground. Come summer, lovely succulent, blue-green leaves are topped with clusters of buds, similar to broccoli in the palest of greens. Orange butterfly weed (*Asclepias tuberosa*) makes a drop-dead combination with it in July. In the fall, the flowers open, changing from green to pale pink to rose to brick red. By December, the dried flower heads have turned a rusty red; as winter takes hold, they become a warm brown, and continue that way until the gardener sees fit to remove them to make way for the new spring crop of "Brussels sprouts."

The particular rose-red tone of the sedum's fall-blooming flowers is difficult to combine with the prevalent purples, lavenders, yellows, reds, and oranges of autumn. A successful marriage occurs between *Sedum* 'Autumn Joy' and several of the ornamental grasses. In many gardens, these plants have become regular garden partners. But a garden cliche is never as wearying as a literary one; old roses still go beautifully with catmint and lavender, pansies continue to enhance tulips, the French marigold and dusty miller still make a great couple. Combining *Sedum* 'Autumn Joy' and grasses is always a delight.

Early-blooming varieties of maiden grass (*Miscanthus sinensis*)—'Silberfeder' and 'Purpurascens'—are best for dramatic backlit effects. Because their tassels appear in midsummer rather than in the fall, they've already dried and are silvery-white by the time autumn rolls around. *Miscanthus sinensis* 'Purpurascens,' the shorter and more erect of the two, has foliage that turns shades of flame, burnt orange, red, and maroon. A lone clump of this plant, proudly carrying gleaming white plumes over a deep red mound of linear leaves, makes a fine specimen plant. The profuse white spray of thousands of small daisies tumbling from *Boltonia asteroides* 'Snowbank' in early fall might make a good companion. Both these plants perform best in full sun, with a medium amount of water.

The narrow-leaved, gently arching *Miscanthus sinensis* 'Gracillimus,' is one of the last grasses to bloom, waiting until fall to put out its silken, mauve-colored tassels. This five-foot garden giant might be combined with a late-blooming perennial that can match it in size and effect: *Eupatorium maculatum,* known as Joe Pye weed in the Midwest and East, where it grows wild in water — retentive clay soils in full sun. This plant's old-rose-colored flowers attract late-season butterflies and bees, and the cultivar 'Purpureum' echoes the mauves of the combination in maroon-tinted stems and leaves.

One other grass that waits until fall for its show, is *Chasmanthium latifolium*. This native grows from one to two feet, therefore is integrated into the small garden with greater ease than the maiden grasses. Its leaves turn a subdued golden color; its dangling flower spikelets, a warm copper. A versatile little grass, *Chasmanthium latifolium* tolerates moist to quite dry soils, and sun to part shade. The deep yellow flowers of *Rudbeckia fulgida* 'Goldsturm,' still going strong in autumn after two months of bloom, make a good companion.

Without question, trees and shrubs add most of the foliage color to the fall landscape, but there are a few perennials that turn equally brilliant. Poor soil and full sun bring out the most fiery tones. The large, waxy, evergreen leaves of *Bergenia cordifolia* turn a warm scarlet-tinged mahogany and remain through the winter, Balloon flower's (*Platycodon grandiflorus*) foliage becomes a bright straw yellow. On occasion, even peonies have been known for a good fall foliage show. An almost surreal fall color combination is the deep, true blue of the last flowers of false plumbago (*Ceratostigma plumbaginoides*), glowing on its scarlet foliage. As the year draws to a close, the tough groundcover Himalayan border jewel (*Polygonum affine*) also sets its leaves on fire. Plant a few late-blooming gentians like *Gentiana septemfida* close by for more of that vibrant red and blue effect.

In the shady fall garden, bright colors are more the exception than the rule. Blue and red is still possible, however, with Eastern native cardinal flower (*Lobelia cardinalis*) and the hooded, blue-purple flowers of *Aconitum carmichaelii,* the latest monkshood to bloom. Cardinal flower supposedly likes moist areas, but I've grown it quite dry. Many "rules" for plants can be broken, even hardiness-zone information. It's much more helpful to find out where the plant grows naturally, and just give the poor thing, albeit branded "zone X," a try.

Blue-flowered willow gentian (*Gentiana asclepiadea*) is a late-blooming candidate for the moister shade garden. The graceful, drooping yellow and chartreuse foliage of *Hakonechloa macra* 'Aureola,' a rare variegated grass for shade, would make a lovely accompaniment.

Light colors — white and the pastels — are at their best in the shade. The pale pink or white flowers of Japanese anemone, *Anemone* x *hybrida* are carried high above the grape-like leaves on airy, yet sturdy stems. The flowers, charmingly simple of face, might make a nice contrast to the white bottle-brush spikes of another fall-bloomer, *Cimicifuga simplex*. A newer, more unusual form of this perennial, *C. simplex ramosa* 'Atropurpurea,' has leaves and stems a dark plum-brown color, showing off the white flowers to great advantage. The silver and burgundy fronds of Japanese painted fern (*Athyrium nipponicum* 'Pictum') would front it well, with a spangle of rose-pink, fall-blooming cyclamen (*Cyclamen hederifolium*), threaded throughout.

Away from the shade, a rich yellow sun shines and the sky is deeper blue now than it's been all summer: blue and yellow — always a classic pair. The fall garden, not to be outdone, responds with its own spots of sunlight and sky: warm yellow *Sternbergia lutea,* looking like a big crocus without leaves, next to the haze of blue mist spirea, *Caryopteris* x *clandonensis.* Or a pair of tall natives: airy *Salvia azurea,* sending up spires of gentian-blue flowers alongside the sunny gold faces of Maximilian's sunflower (*Helianthus maximiliani*). Add the deepening red foilage of a sumac, burning bush (*Euonymus alata)*, or *Amelanchier* as a backdrop, and you will truly drink from the richness that is fall gardening.

These are but a few of the possibilities. Come fall, when you see the roadsides lined with sunflowers, a haze of lavender and white asters beneath the ponderosa pines, and the fields ablaze with purple liatris, goldenrod, and swaying grasses, let them inspire you to create a wonderful fall perennial garden for yourself.

Lauren Springer received her master's degree in horticulture from Penn State, and gardened in public and private gardens on the East Coast, in England, and Ireland before settling in northern Colorado. Her artistic approach to plants and gardening is reflected in her designs, photography, teaching, and writing.

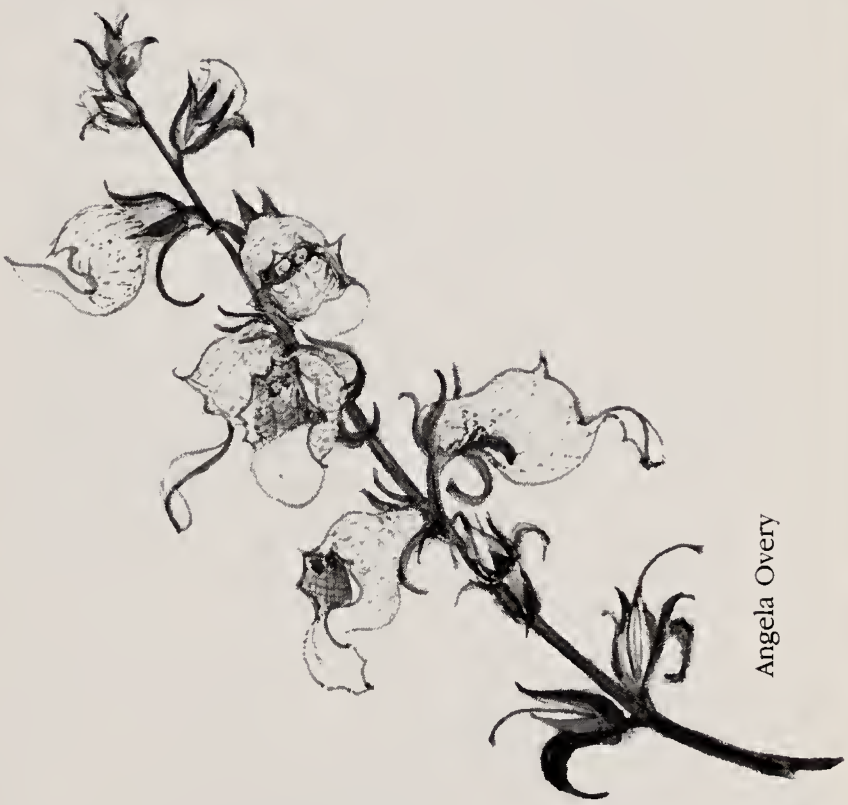
Digitalis lanata

by Angela Overy

"Digitalis" derives from the Latin word for finger, but I prefer the name foxglove—and the image of these cunning animals donning silky gloves to perform their more dubious tasks. *Digitalis lanata,* of Eastern Mediterranean origin, is a splendid flower to grow in Colorado. It should not be confused with the purple foxglove we are familiar with from Celia Thaxter's garden at the Denver Botanic Gardens, or from the moist, traditional English woodland garden.

Digitalis lanata is a much tougher plant, more suited to a Front Range xeriscape garden. It can be biennial, flowering its second year and then dying, or sometimes a short-lived perennial. The first year, it makes a rosette of dark green foliage, about nine inches high. Do not be tempted, however, to put other plants too close the following spring. In June, spires shoot up to four feet high. Buds open into cream-colored "gloves," laced with coffee-brown veins; the lower edge of the flower has a drooping white lip that almost glows in the early morning and evening light.

Digitalis lanata blooms for six weeks or more. It is also an excellent cut flower, adding interest and unusual brown color to a bouquet, and lasting in water for a week or more. This foxglove requires a sunny location, and only occasional extra waterings beyond Colorado's natural rainfall. With liquid fertilizer added about every two weeks in June and July, a grouping will produce a dazzling display. They form prolific amounts of seed, which germinates readily, so you need not be concerned about the relatively short lifespan of the individual plants.


Angela Overy

The unusual cream and soft brown color of the flowers blends beautifully with buff flagstone and adobe. Don't try to mix it with too many other plants, however. Its elegant beauty is best appreciated separately.

Angela Overy teaches botanical illustration and floral design at Denver Botanic Gardens. Her garden will appear in *Fine Gardening* this winter.

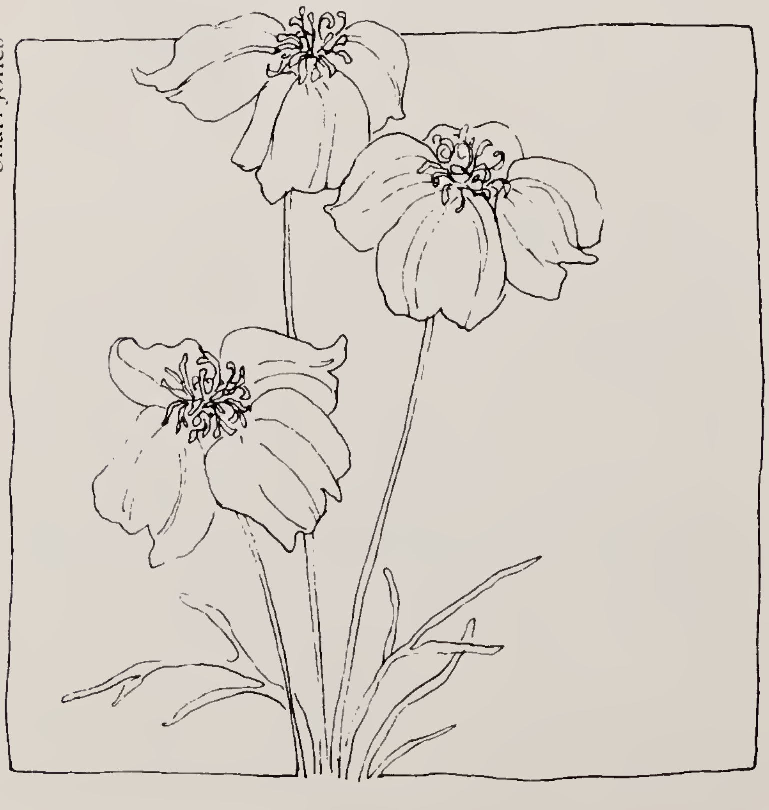
Zinnia grandiflora

by Andrew Pierce

This native perennial, known as Rocky Mountain zinnia, has had its botanical name changed, like so many others. Originally it was classified as *Crassina grandiflora* (Nutt.) Kuntze, but since 1923, its name has honored Johann Zinn, an eighteenth-century German known for his botanical work in New Mexico.

Zinnia grandifora's pretty little 3/4 inch flowers may not live up to the name given it by Nuttall, "grandiflora," on an individual basis, but when massed together, they certainly are "grand," due to their profusion. The plant doesn't look at all like the common, multi-colored, annual garden zinnia. The golden flowers have four or five ray florets, resembling papery petals, that form a complete circle. The disk florets in the center form a darker, reddish eye. The plant blooms a very long time—from May until September.

Rocky Mountain zinnia is a semi-woody perennial, becoming more shrubby farther south. It grows naturally at elevations between 4,000 and 6,000 feet, but still may not always be completely hardy in the Denver area.



Shari Jones

Zinnia grandiflora's stems may be up to eight inches long, but they tend to flop, resulting in a plant rarely more than a few inches high. In *Jewels of the Plains*, Claude Barr, one of the greatest plant collectors, called this plant a golden gem, and suggested "freer increase would be welcome." Today, it is finding its way into the listings of many local nurseries.

In 1980, Panayoti Kelaidis and I introduced Rocky Mountain zinnia into cultivation by taking cuttings from a few plants scattered on the rough slopes of Phantom Canyon near Canon City. Since then, it has been widely propagated by seed, and is usually available at the DBG spring plant sale. Growth may appear slow at first, but the plant's fine roots penetrate a moderately well-prepared soil rapidly. Then a series of shoots develop, and by July, masses of flowers appear that continue blooming until frost. Good drainage helps insure overwintering.

It seems that *Zinnia grandiflora* is not a long-lived perennial in cultivation. Sometimes only a few underground runners survive, or a handful of self-sown seedlings, which help prolong the life of group plantings.

No matter how long its life in the garden, Rocky Mountain zinnia is an unusual native beauty that is garden-worthy, especially for its long season of show and drought-tolerant qualities. It is hoped that the plant's popularity will continue to grow, and that springtime shoppers will see the potential in not-yet-flowering specimens, and not forego them in favor of their gaudy cousins.

Andrew Pierce is Assistant Director of the Denver Botanic Gardens. His garden in Evergreen, CO, was recently featured in *Fine Gardening*.

Callirhoe involucrata

by Kelly Grummons

Growing up in the southern Black Hills of Wyoming and South Dakota instilled me with a great appreciation of prairie flora. One of my favorite native flowers is the prairie winecup, *Callirhoe involucrata*.

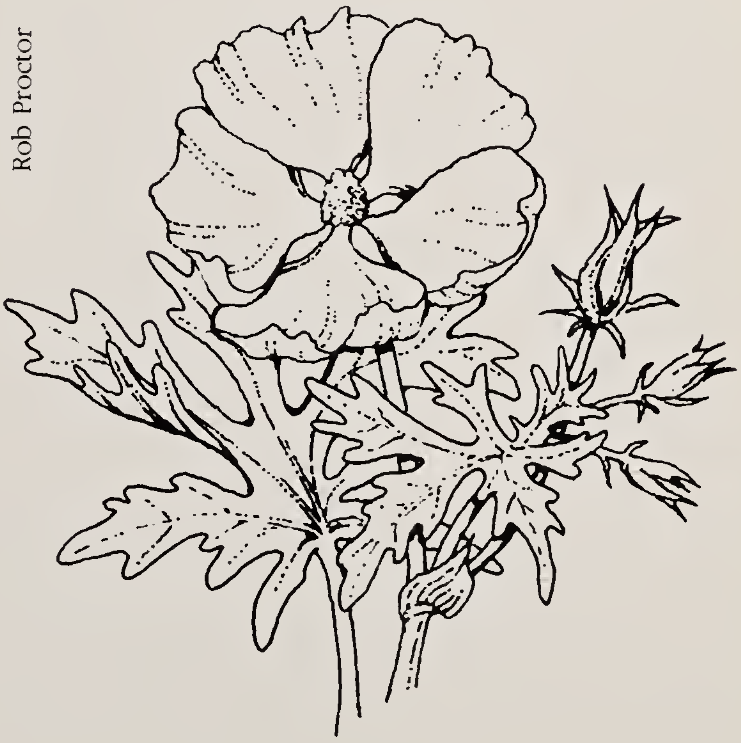
My mother, also a lover of this chest of botanical treasures, told me a childhood story about the winecup. She was spending a summer on her great-aunt Esther's ranch in South Dakota. On the way back from a hot, dusty hike, my mother came across a most glorious flower. Knowing Aunt Esther bred African violets and was a lover of plants, Mom pulled up the mass of rambling stems and wine-rose flowers of *Callirhoe involucrata* to give to her aunt. Esther's appreciation quickly turned sour upon discovering that the plant was crawling with large, neatly-camouflaged buffalo leaf-hoppers. In spite of the bad experience with the bugs, Mom still has prairie winecup in her Wyoming garden.

Callirhoe involucrata grows sparsely in the southern Black Hills, becoming more abundant in the sandier soils of western Nebraska, Kansas, eastern Colorado, Oklahoma, and Texas. Generally you will find it growing on flat grasslands at elevations between 1000-3500 feet. Its two-inch, wine-rose flowers bloom abundantly from June through September and are held well above the rambling, dark-green foliage. In July and August, if you drive slowly through western Kansas you will be rewarded by acres of glorious gayfeather (*Liatris sp.*), asters, and winecups. I don't understand why people call this area a vast wasteland.

Prairie wine-cup is one of the easiest wild flowers to cultivate in your garden. It thrives in clay or sand, with moderate or little water. The drier the soil, the more compact the plant. *Callirhoe involucrata* enjoys full sunshine but will tolerate quite a bit of shade. It fits wonderfully into informal mixed borders, especially when allowed to ramble among the other plants. Its wine-rose flowers are shockingly delightful with many other colors, but especially when seen peeking through the silver leaves of artemisias, *Stachys byzantina,* or some *Salvia* species. This native perennial easily gives as much seasonal color as many annual flowers.

Prairie winecup deserves more attention from the nursery trade. It has been promoted as a xeriscape plant for several years, yet supplies have been limited. Some local nurseries carry it, and the plant is propagated by seed sown in the garden in October or November.

Kelly Grummons received joint degrees in horticulture and landscape management from Colorado State University, and is horticulturist at Paulino Gardens in Denver. He has a special interest in prairie plants.


Rob Proctor

Tiarella wherryi

by Pat Hayward

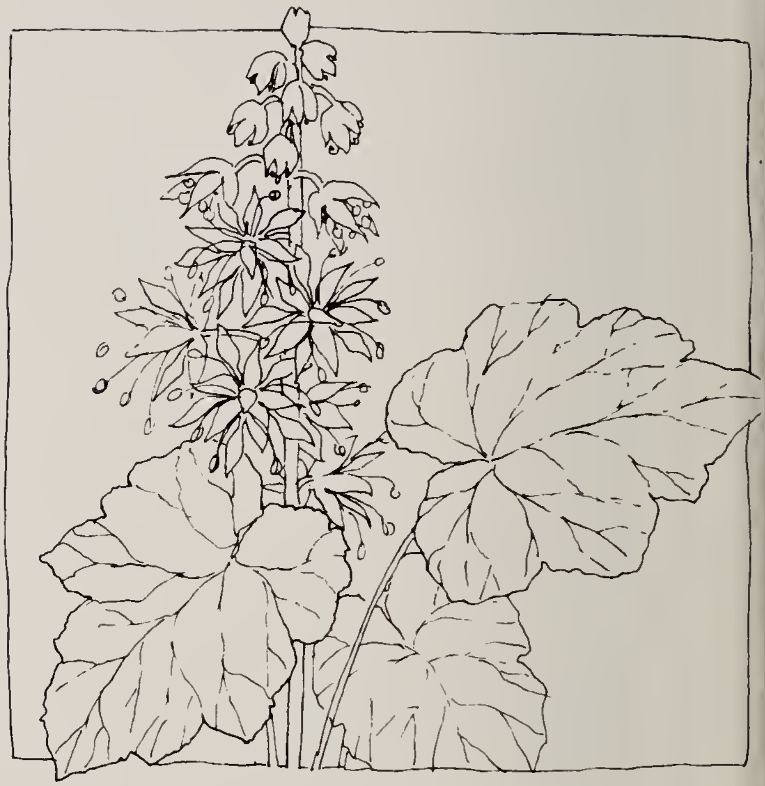
Until recently, new and different perennials for shade have been hard to come by in Front Range nurseries. Because of the interest in dryland and native plants, local growers have emphasized the growing and introduction of sun-lovers and survivors of heat and drought.

But what about those of us with older gardens that are shaded by tall trees? Whether for the large woodland garden, or that small, north-side-of-the-house border, we need more interesting shade-loving choices.

I've worked in sales and marketing at a local nursery for six years. In the summer of 1988, we were given the challenge of locating and growing "new" varieties of shady perennials for the Denver Botanic Gardens plant sale. I felt impelled to try them in my garden.

One of the biggest surprises was *Tiarella wherryi,* also known as *Tiarella cordifolia var. collina,* or foamflower. This Southeastern woodland native was thriving beautifully in my dry, shady Colorado garden. I always joke with customers who ask for a hardy, evergreen perennial that blooms all summer and requires no maintenance; once in a while, a real prize like this actually shows up.

Foamflower emanates softness. It is a tidy, non-spreading perennial with medium-green, fuzzy, palmately-lobed leaves. In the fall and winter, reddish-bronze tones become more pronounced in the semi-evergreen foliage. Six to twelve inch spikes of pink-edged, white flowers, shaped like tiny stars, float above the four to six inch mound of leaves. Blossoms are heavily produced in May and June, then more subtly the rest of the summer. It is common for my young, two-year-old plant to have fifteen spikes in bloom at the same time.



To compensate for my lack of interest in, and time for watering, I purposely made my shady bed heavy in soil, mixing compost and peat with a mostly-clay base. The clay holds the water well, and the peat adds just enough richness and acidity. My foamflower seems happy with the mix, along with painted fern (*Athyrium nipponicum* 'Pictum'), *Hebe* 'Carl Teschner,' *Hepatica triloba, Alchemilla mollis,* and others.

Tiarella wherryi is usually propagated by division, as seed is rarely available. This plant may not be flashy or loud, nor will it make the list of the top ten most colorful perennials. But it is subtle, attractive, hardy, looks good in the winter, and grows and blooms in shady gardens here in Colorado, where it deserves a better place.

Pat Hayward is a perennial specialist at Little Valley Nursery in Brighton, CO. She writes and teaches extensively.

Delphinium grandiflorum

by Sandy Snyder

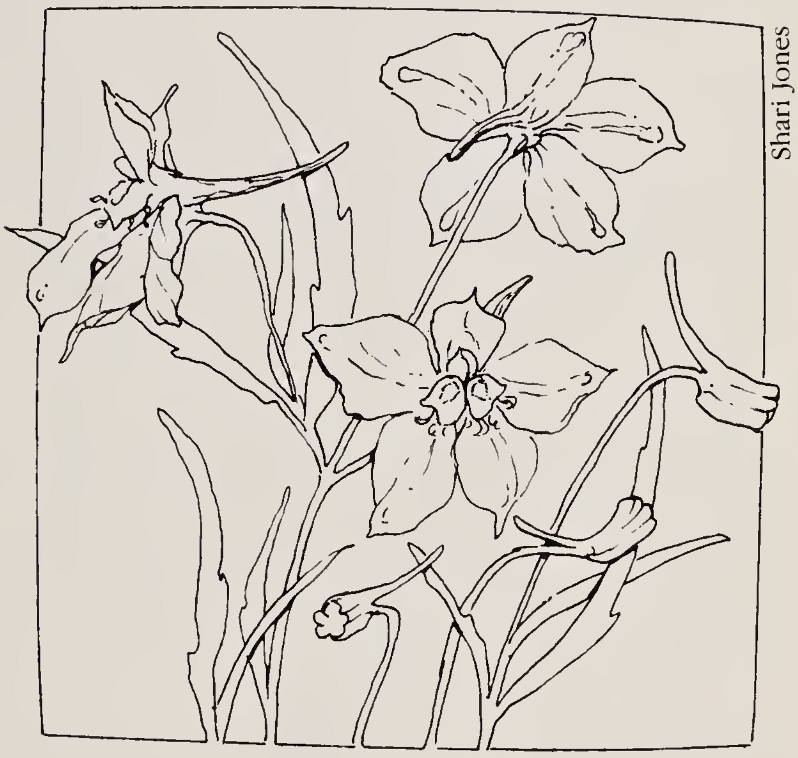
Many gardeners I know have a terrible time trying to grow gentians or the blue Himalayan poppy (*Meconopsis betonicifolia*). Then they must forego that breathtaking color, cobalt blue, in their gardens, unless they know about *Delphinium grandiflorum,* also known as *D. chinensis*. This plant is a gardener's delight: it is easy to grow, the color is unsurpassable, and it provides a burst of flowers in midsummer, when most gardens need a lift.

I have fallen in love with *Delphinium grandiflorum*. It gives my garden a sweep of gentian blue, my favorite color. My form of this plant is deep blue, but L. H. Bailey in *The Garden of Larkspurs* says that bouquet larkspur, one of its common names, comes in all ranges of blue and blue-purple, mauve, reddish, and clear white.

Delphinium grandiflorum is a perennial from China and Siberia. It is so easy to grow that I had forgotten I had it until mid-July. Suddenly, on two-foot, airy stems, a crowd of little blue flowers magically appeared. I had done nothing to encourage these plants, and they still put on a show. Next year I will observe them closely to see how truly perennial they are.

By mid-August, the plants still are blooming a little, but mostly look like dry candelabras of seed heads. I let these silhouettes remain to encourage them to send wherever they want. If I decide to arrange them along the front of one of my perennial borders, as one book suggests, I will dig up the seedlings in the spring and rearrange them as I replant them.

Delphinium grandiflorum has no pests or diseases, behaves itself in the garden, and is easily shared and propagated just by shaking the dried flower stalks around. I can still be enticed to travel far to see gentians and the blue poppy, but the rich blue sweeps in my summer garden make it easier to wait for those trips to faraway places.

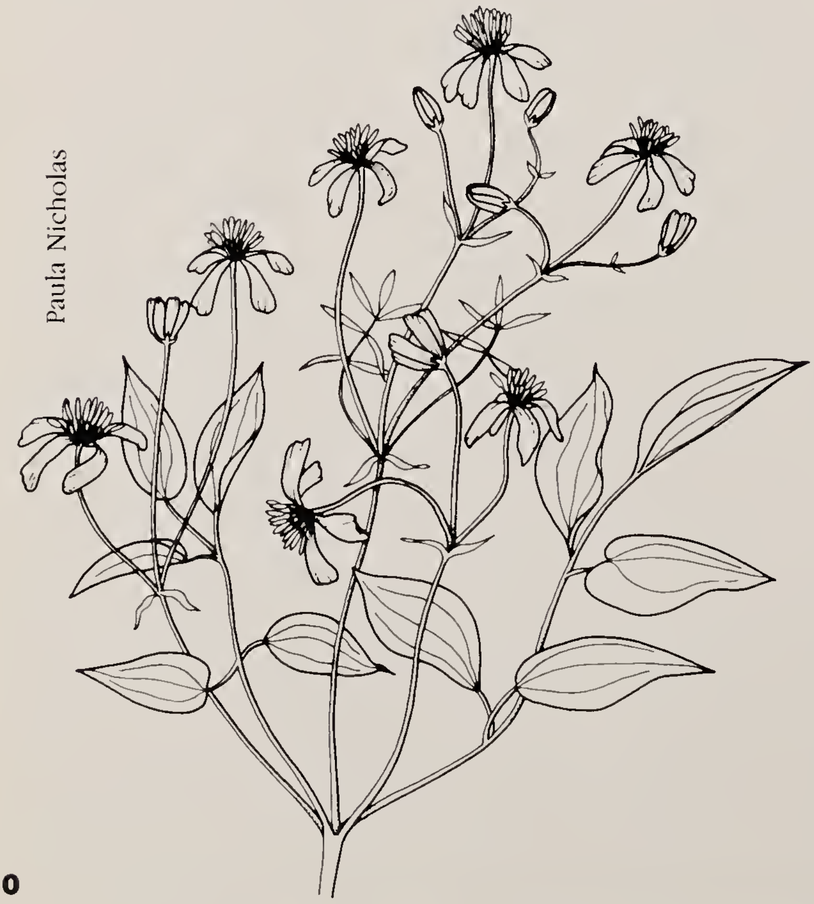

Shari Jones

Sandy Snyder is a gardener in the Rock Alpine Garden at Denver Botanic Gardens. She also has her own landscaping and consulting business, and writes and teaches on the side. Her garden in Littleton, CO, has been the subject of several articles, both locally and nationally.

Clematis recta

by Jane Silverstein Ries

The perennials in my urban garden are a constant source of joy. Most of the plants must fight for space and sunlight; some of the best are seldom seen in other gardens. One of my favorites is *Clematis recta*. Though I grow a number of the climbing species and hybrids of the genus, I find this clematis special in that it grows upright to only three feet, making it suitable for the perennial border. The abundant moisture in the early part of 1990 (never have I witnessed a more perfect spring) encouraged *Clematis recta* to grow an additional foot in height, as did many other perennials.



Paula Nicholas

Clematis recta blooms in June with clusters of sweet-smelling, creamy white flowers. The plant needs a bit of inconspicuous support, such as stakes or a hoop, to be seen to advantage. Though my garden is fairly shady, this plant thrives in a position where it receives sun during midday for three or four hours.

Clematis recta is native to southern Europe. It is amazing — and frustrating — that this wonderful, old-fashioned plant has virtually disappeared from commerce. It was formerly grown on a large scale in Denver for the cut flower trade. Although it has not expanded in size or seeded itself, the one plant in my garden has grown for more than a decade and returns faithfully every year.

In the garden, this plant combines well with other under-used perennials. For example, *Clematis recta* may be planted in front of another of my favorites, feathery *Valeriana officinalis*. *Clematis recta*'s attractive, fluffy seed heads are accented when in front of the purple spikes of monkshood (*Aconitum napellus*). The outstanding foliages of coral bells (*Heuchera sp.*), lady's mantle (*Alchemilla mollis*), and barrenworts (*Epimedium sp.*) look beautiful planted at its feet.

One of the country's first women landscape architects, Jane Silverstein Ries has been designing gardens, as well as tending her own, for over fifty years in Denver. The American Society of Landscape Architects Colorado Chapter award for excellence in land use bears her name and is given in her honor annually.

Anemone hupehensis

by Tom Peace

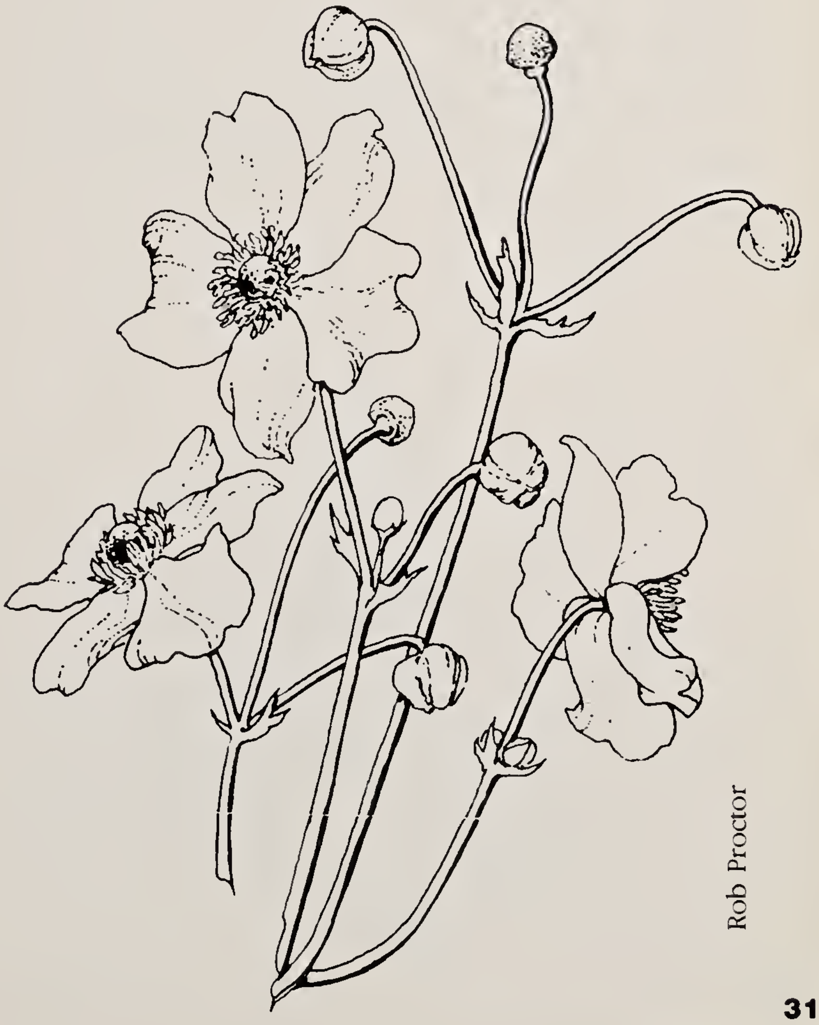
One of the highlights of August is the advent of the pink, pearly buds of Japanese anemone. The large, dark green leaves with their bold, angular shape grace the partly shaded perennial border or woodland garden for most of the summer. As the buds arise from the foliage on strong, yet delicate stems, the anticipation of a floral fantasy amid the late-summer doldrums builds.

Japanese anemone is currently classified as *Anemone hupehensis,* although *A. japonica* is sometimes still used, and other species, cultivars, and hybrids incude *Anemone* x *hybrida* and *A. vitifolia* 'Robustissima.' A gardener is lucky to find any of these hardy, versatile perennials, but I prefer *Anemone hupehensis* over the others. It blooms a bit earlier, and on shorter stems. Fortunately, it is easy to multiply by crown division, root cuttings, or by simply allowing a plant enough room to make a dense colony. When the gardener finds the form of this flower he or she likes best, it's soon possible to have it everywhere.

Versatile *Anemone hupehensis* can be planted in sun or shade, and performs well as long as it is in a moist, well-drained garden loam. Established plants can tolerate more dryness. The dramatic leaves grow from twelve to eighteen inches high, with white undersides. The flower stems rise an additional foot above the foliage. Unsurpassable clear pink flowers, two inches across, bloom from the middle of August until a hard frost stops them.

Japanese anemone has no predisposition to pests or disease. The only problem the gardener encounters is the wait for late summer's bounty of bloom. High altitude gardeners can also enjoy this plant; I have grown it successfully in the Aspen Valley. I have found that an asexually-propagated clone of *Anemone hupehensis* formed buds at the same time in Carbondale, Denver, and Austin, Texas.

Colorado State University-trained Tom Peace is a freelance landscape designer in Colorado and Texas.



Rob Proctor

Agastache cana

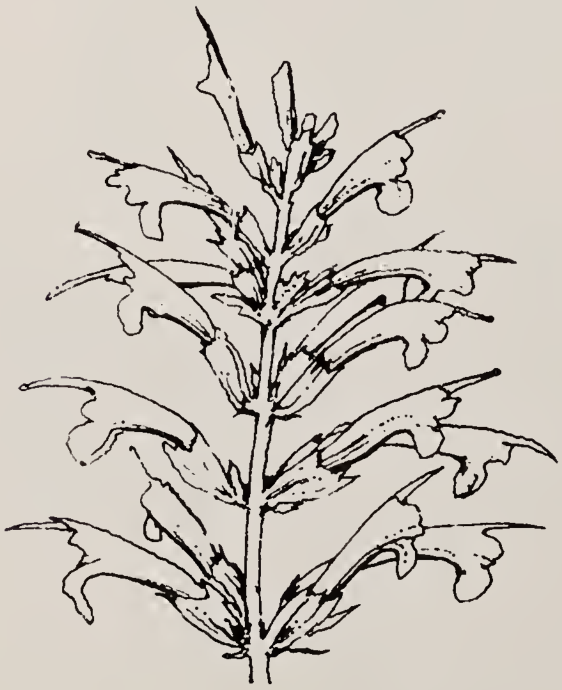
by Jim Knopf

This perennial smells just like old-fashioned Double Bubble gum, so I like to call it double bubble mint. It is very showy, easy to grow, doesn't need much water, hummingbirds love it, it blooms for a long time, and is easy to propagate from seed. It's also considered rare, and possibly endangered, in New Mexico.

You may wonder how a plant with so many desirable traits can remain almost unknown to local perennial sleuths for so long. It probably has a lot to do with an old bias toward introduced over native plants. Fortunately, this is changing.

Agastache cana's fragrant, pink flowers bloom from late July until mid-October. The foliage is fragrant as well, but more minty than bubblegummy. The plant grows to three feet and is about two feet wide. It thrives in full sun, tolerating dry situations, but growing to its most lovely potential when given about 3/4 inch of water weekly in midsummer when there is no rain.

Double Bubble mint is easily grown from seed that has been given a period of cold, damp conditions for two months. Its showy, fragrant, long-blooming flowers, ability to grow in semi-arid garden conditions, and strong attraction for hummingbirds all make it a wonderful addition to the perennial palette.



Rob Proctor

Our region is bountiful in "weeds with potential." Chocolate flower (*Berlandiera lyrata*) and Indian pink (*Silene laciniata*) are two more. Many local "weeds," occasionally defined as plants with a greater will to live, or plants we haven't learned to love yet, are worthy of serious attention. In fact, given new names and some exposure, these plants are likely to change from targets of misguided local weed ordinances to the coveted status of "designer weeds," and we are all the richer for it.

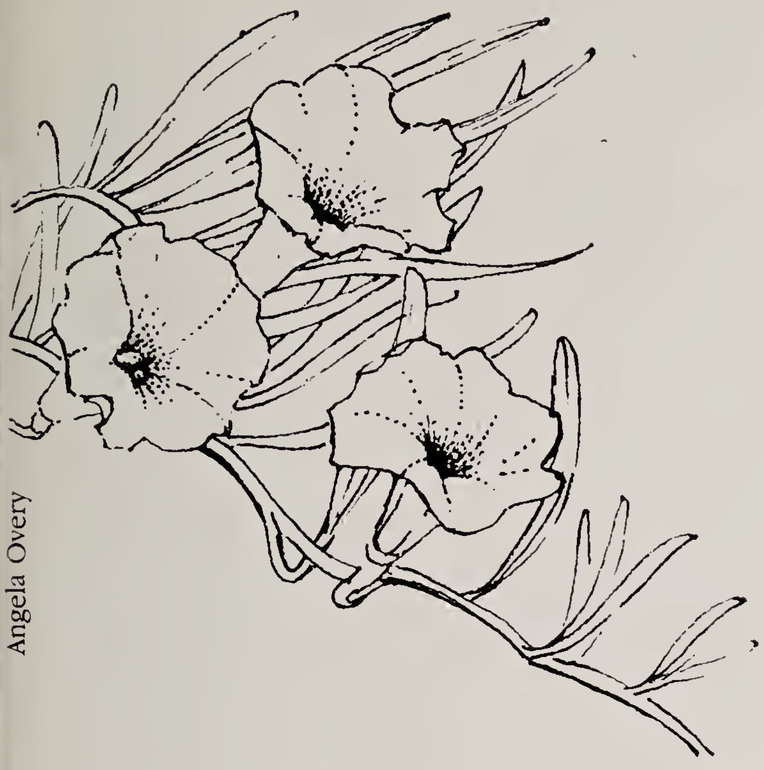
Jim Knopf is a maverick landscape designer based in Boulder, who specializes in designer weeds.

Ipomoea leptophylla

by Ray Daugherty

Ipomoea leptophylla, also known as bush morning-glory, is a herbaceous perennial locally abundant on the plains of Wyoming, Colorado, and New Mexico, especially along roadcuts and on sandy slopes. This deep-rooted plant is reminiscent of a small willow in leaf. Its showy, two to three inch, funnel-form flowers bloom all summer in shades of rose-purple and violet. Bush morning-glory is drought-tolerant, but may go dormant under extremely dry conditions. It prefers sandy soils, but tolerates clay if very good drainage is provided.

In the garden, *Ipomoea leptophylla* works well as an erosion-controlling plant on steep slopes, as a small shrub-like feature in the back of the dryland border, or as an accent plant near large stones. Take great care to insure perfect drainage,


Angela Overy

especially during the winter. This plant has an enormous root that can reach twelve feet or more in length and depth and that may be as big around as a person's leg. Due to this root, bush morning-glory is nearly impossible to transplant from the wild, or to move after establishment.

At this point, it is still scarce in commerce, so seed is the best method for obtaining it. Germination is quick and easy after the seeds are soaked overnight in hot water. Plant the seeds at a depth of about 1/4 to 1/2 inch, where it is to grow.

Ray Daugherty is propagator at Green Acres Nursery in Golden, CO.

Thalictrum minus

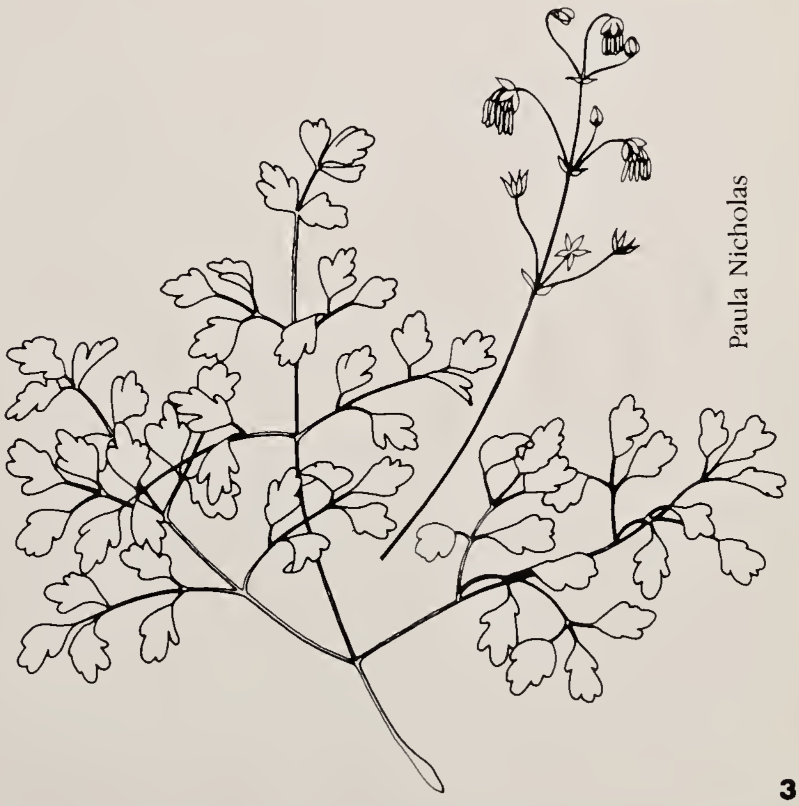
by James E. Klett

This perennial, also known as low meadow rue, forms an airy mound of foliage reminiscent of maidenhair fern (*Adiantum pedatum*). It grows to approximately one and one half feet in height, and two feet in width. *Thalictrum minus* blooms along the Front Range of Colorado from late May to early July. The plant is an asset in the garden throughout the growing season because of its excellent foliage. The flowers consist of tufts of dangling green-yellow stamens of modest ornamental value. Bright red fruits follow a few weeks after bloom, and are quite showy.

Low meadow rue seems to grow best in partial shade and fairly moist, rich soil. In cooler areas, and especially at higher elevations, it tolerates full sun. The beautiful, dainty foliage can also be cut and used in flower bouquets. A related species, *Thalictrum adiantifolium,* is taller and more invasive.

We have grown this plant for over ten years in our perennial trials at the W.D. Holley Plant Environmental Research Center, and it has never suffered any winter damage. It is most vigorous when planted in a partially shaded spot and given some additional moisture. Hostas make attractive companion plants, creating contrast of leaf form and texture.

James E. Klett is Associate Professor of Ornamental Horticulture at Colorado State University. Eleven years ago, he started the extensive perennial trial gardens there.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Front Cover: Jim Knopf
Verbena tenera sets a berm on fire at Denver Botanic Gardens.
Back Cover: Rob Proctor
Verbena bonariensis, fountain grass (*Pennisetum setaceum*), black-eyed susan (*Rudbeckia hirta*), *Verbena rigida* and creeping zinnia (*Sanvitalia procumbens*) evoke the colors of late summer and fall on the prairie.

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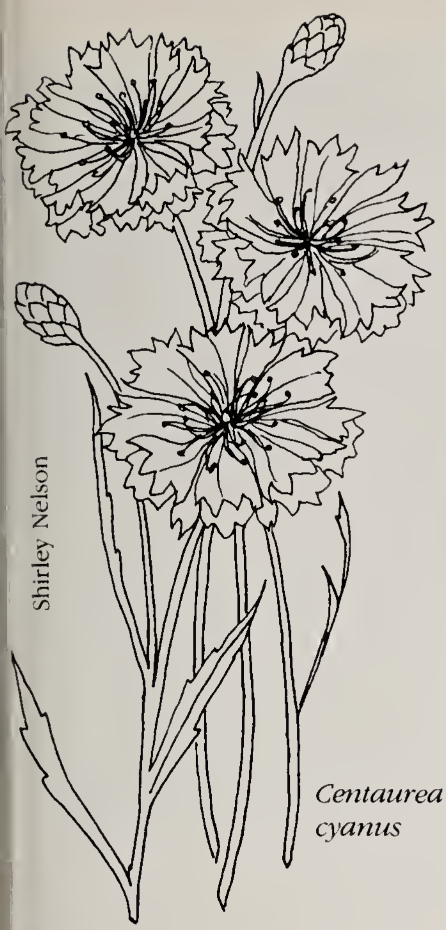


Shirley Nelson

Centaurea cyanus

A Taste of Annuals as Seen from Denver Botanic Gardens

by Andrew Pierce

From just an inch or so to over six feet tall, annuals offer a wealth of variety to please everyone. They are the backbone of many of the Rocky Mountain region's summer gardens; our climate is exceptionally suited to growing them well. Gardeners in some not-so-distant areas such as Seattle find these plants quite difficult to grow while we take annuals for granted here; cool winters, moister springs and hot, dry summers produce lovely displays of annuals.

The annual summer splendor is really not what it seems. Botanically, an annual is a plant that grows, flowers, sets seed and dies within one growing season. Surprisingly, many of the plants commonly called annuals do not meet these criteria. In many instances, these "annuals" are actually biennials, perennials, shrubs and even plants with storage organs such as cannas (*Canna* x *generalis*) and dahlias. Consequently the gardener's term "annual" actually refers to seasonal usage rather than true botanical characteristics: any plant that exists in the garden for only one growing season, whether due to an inability to live through a hard winter, a natural inclination to die after setting seed, or simply because it is easier and more effective to replace and replant it yearly, is termed an annual. It would be a much duller world if we confined ourselves to only true botanical annuals; marvelous plants like geraniums (*Pelargonium spp.*), the foliage plants *Coleus* x *hybridus* and dusty miller (*Senecio cineraria*), bold cannas, flowering maple (*Abutilon hybridum*), fragrant oleander (*Nerium oleander*) and the luxuriant tuberous begonias (*Begonia* x *tuberhybrida*), among others, would all be relegated to non-use status.

Ever since annuals were first used to a great extent back in the early Victorian era, gardeners have looked to them for their bold color effect to magnify the summer spectacle in the garden. Today a few original, non-hybridized species are still grown, but in almost all cases, cross-pollination and selection have improved the plants. In 1989, when trying to obtain the original species of plants for the Celia Thaxter Garden at Denver Botanic Gardens, we encountered considerable difficulty finding varieties of single-flowered hollyhocks (*Alcea rosea*) and un-hybridized bachelor's buttons (*Centaurea cyanus*). These older forms of annuals are rarely found in commerce, and in some cases, are no longer around at all.

A large majority of annuals originated in the New World, including the familiar petunia (*Petunia* x *hybrida*), marigold (*Tagetes spp.* and hybrids), flowering tobacco (*Nicotiana alata*), garden salvia (*Salvia splendens*) and zinnia (*Zinnia elegans*). The flare of annuals' popularity in Europe in the 1800s was no doubt due in great part to their introduction and novelty at the time. From South Africa came the "geraniums" we grow as annuals and some of the newer daisies such as *Gerbera jamesonii*, star-of-the-Veldt (*Dimorphotheca spp.*) and blue marguerite (*Felicia amelloides*). From the Mediterranean region came pot marigolds (*Calendula officinalis*), bachelor's buttons and snapdragons (*Antirrhinum majus*), to name a few. North America contributed California poppies (*Eschscholzia californica*), the satin flowers (*Clarkia spp.*), annual coreopsis (*Coreopsis tinctoria*) and ghostweed (*Euphorbia marginata*).

As Denver and the rest of the Rocky Mountain region become more aware of environmentally sound landscaping, annuals will be considered for more than sheer beauty. Already certain plants such as moss rose (*Portulaca grandiflora*), mealy-cup sage (*Salvia farinacea*), creeping zinnia (*Sanvitalia procumbens*), various *Verbena* species and ghostweed are valued for flourishing on less water than the staples petunia, snapdragon, geranium and marigold.

The broader interpretation of the term "annual" invites use of more unusual plants in that capacity. For several years the Gardens has used ornamental peppers (*Capsicum annuum*) in varying forms for the beauty of their fruit. Castor bean (*Ricinus communis*) also offers showy fruit, with bright red, spiny capsules, not to be eaten, however, since they are very poisonous. This year, large sub-tropical plants — oleander and *Pittosporum spp.* — will be underplanted with drifts of plants usually thought of as foliage house plants but perfectly suited for annual use in the garden: spider plant (*Chlorophytum comosum*) and wandering jew (*Tradescantia albiflora*). I always enjoy the annual display of ornamental kale and cabbage (*Brassica oleracea*) up in the mountains by Echo Lake Lodge at the base of Mount Evans on the Front Range. This interesting use of annuals has considerable merit in that not only are the plants hardy and colorful, but the common annuals they replace, such as petunias, geraniums and zinnias, would either be frosted or fail to produce adequate flowers at that elevation, where no month is frost-free. An interesting effect might include parsley (*Petroselinum crispum*) as a groundcover or edging to a border, or even ornamental leaf lettuce (*Lactuca sativa*).

For drying, daisy-like strawflower (*Helichrysum bracteatum*) and winged everlasting (*Ammobium alatum*) are old standbys. Globe amaranth (*Gomphrena globosa*) is another: the newer variety 'Strawberry Fields,' a rich red, drew a good deal of attention in the Denver Botanic Gardens cutting garden last year, as did orange *Gomphrena haageana*. Statice (*Limonium sinuatum*) is always admired but unfortunately not easy to find as young starts on the market. Its tall flowering spikes, in a wide range of colors, are very eye-catching. Bells-of-Ireland (*Moluccella laevis*) have been cultivated for their dried, papery flower calyces for many years, as have the charming seedpods of love-in-a-mist (*Nigella damascena*) and showy cockscombs (*Celosia cristata*). Annual grasses contribute a grace of form and texture to the dried arrangement.

In the casual garden, for the lazy gardener, a number of annuals I like to call "perennial" annuals come in handy. This group of versatile plants reseed and germinate adequately enough in the garden, without the gardener's interference, that they are reliably present and self-sufficient, year after year. California poppies, annual coreopsis, ghostweed, sweet alyssum (*Lobularia maritima*), love-in-a-mist, *Cosmos bipinnatus*, bells-of-Ireland and even the annual herb borage (*Borago officinalis*) all make themselves at home in the garden enough to be considered "perennial" annuals.

During the last century several annuals were commonly grown that are not well known today. Clarkia, cosmos, *Salpiglossis sinuata*, balsams (*Impatiens balsamina*), stocks (*Matthiola incana*), larkspur (*Consolida ambigua*, formerly known as *Delphinium ajacis*) and poor-man's-orchid (*Schizanthus pinnatus*) were popular. Careful observation points out that these annuals are all generally taller in habit, lacking the bushy, tight "bedding" habit that is stressed in the breeding and production of annuals today. With a resurging interest in old-fashioned, or "cottage" flowers, these annuals are finding their way back into vogue. I have found they work especially well as overplantings in the bulb areas of perennial borders to fill in after the bulbs are spent and to camouflage their unattractive withering foliage. These positions require plants of some height to fit into the border design; the style of these old-fashioned annuals blends much better than would mass displays of petunias, geraniums, zinnias or the heavy formality of *Salvia splendens*.

Time surely changes things. Under "annuals" in *Bailey's Standard Cyclopedia of Horticulture* of 1944, the definitive work of that period and for many years later, there were many plants omitted that are taken for granted today. Most notably absent were the presently-prominent geranium, begonia (*Begonia* x *semperflorens-cultorum*) and dwarf impatiens (*Impatiens wallerana*). Flowering tobacco and annual grasses did not appear either. This was less than fifty years ago.

In Denver and at the Botanic Gardens, the history of the use of annuals is quite rich and fascinating. During the latter part of the 1940s, before the Gardens were established, the city and county of Denver had been using large-scale plantings of annuals for many years already, much as they do today. Marigolds, geraniums, sweet alyssum (*Lobularia maritima*), ageratum (*Ageratum houstonianum*) and petunias were the dependable mainstays. However, they didn't please everyone, especially the more sophisticated gardeners who worked with them. A quote from *The Green Thumb,* Vol. 6, 1949 illustrates this: "To those of us who work with them, these plants fall into certain classifications, like the people we know. Some are completely satisfying — they always have such wonderful color and good growth

A pot overflows with *Lobelia erinus*, trailing vinca (*Vinca major* 'Variegata'), petunias (*Petunia* x *hybrida*) and a spike dracaena (*Cordyline indivisa*).

Andrew Pierce

Mexican sunflower (*Tithonia rotundifolia*) is an imposing plant at six feet.

The vibrant tones of *Nicotiana alata* 'Nicki Red' contrast with perennial lady's mantle (*Alchemilla vulgaris*) in light shade.

Lauren Springer

Petunias and cannas (*Canna* x *generalis*) compliment the soft grey carpet of perennial lavender cotton (*Santolina chamaecyparissias*) at Denver Botanic Gardens.

Andrew Pierce

The red hot fruits of ornamental peppers (*Capsicum annuum*) add spice to a summer display.

that not even a brand new never-did-this-work-before gardener can fail with them. Some we remember because of their definite personalities, or their tendency to be timid and retiring. Then there are the irresponsible ones nobody trusts completely. There are even some unpopular ones that we have tried and tried, and finally given up as hopeless."

Several specific plants appear, disappear, and reappear over the course of the years, proving once again that horticultural fashions are just as fickle and prone to cycles as are other forms of artistic expression. In the early 1960s, a great many trials of annuals were carried out at the young Denver Botanic Gardens, with petunias particularly prominent. In the latter half of the 1960s more emphasis on what would grow in the very hot summer sun and in the shade was being explored, and new varieties of annuals from the All America Selections (AAS) were being tested and evaluated. We continue to carry out the AAS seed trials each year. (See separate article in this issue.)

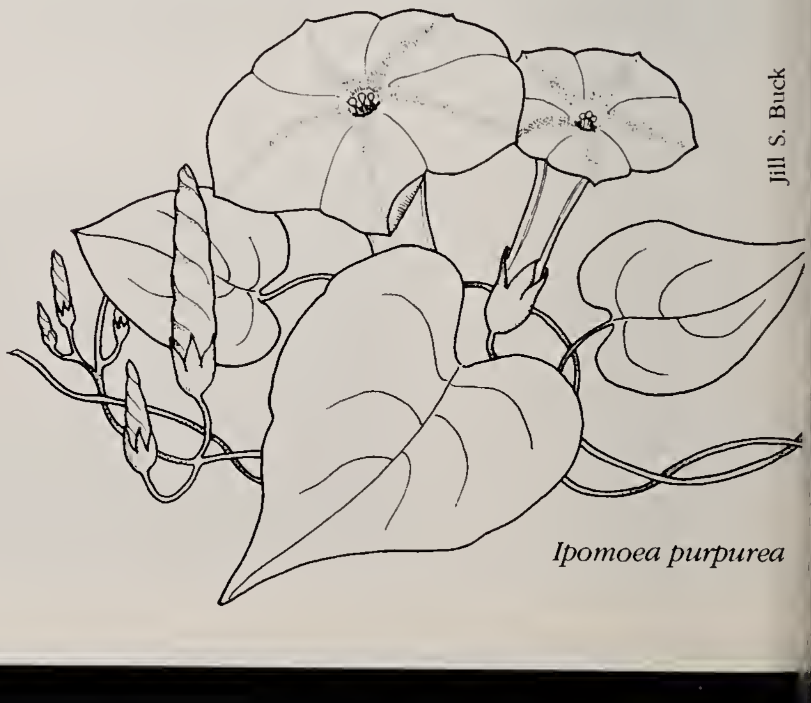
Looking forward to the new annuals of the year is always exciting. Unlike most gardeners who purchase their seed or plants in the late winter or spring of the same year they plan to grow the annuals, the staff members at the Gardens start to put their thoughts together as early as August of the previous year. While this may seem early, it offers the advantage of gleaning new ideas from the annual trials or other areas of the Gardens while they are still in flower. For example, the tall yellow double sunflower, *Helianthus annuus* 'Goldburst' and a variety of false saffron, *Carthamus tinctorius*, both striking plants in the 1990 Gardens, will be featured in the peony garden area in 1991. *Gomphrena globosa* 'Strawberry Fields' from the cutting garden last summer will be more prominent in a large bed to the north of the home demonstration garden, and *Chrysanthemum parthenium* 'Bridal Robe' will appear in a smaller bed near the fountain. Dwarf annual dahlias in the 'Royal Dahlietta' series were excellent in the 1990 trials and some will be planted elsewhere this summer.

Around the amphitheatre there will be chromatic drifts of plants from white to blue, purple to red. Several varieties of petunia, flowering tobacco and tall back-of-the-border spider flower (*Cleome hasslerana*) will create an effect that can be viewed from many angles. These same colors will also appear in the area immediately below the conservatory, one of the hotter areas, which features plants more suited to the Western climate. Pink *Oenothera speciosa* will harmonize with white *Melampodium leucanthum*, a native, and *Verbena tenera* and *V. tenuisecta*. These latter two plants, both from South America, were incredibly popular this past year on the berm to the west of the rose garden. *Verbena tenera* is salmon pink while *V. tenuisecta* is lavender. Though perennial in their homeland, they are not expected to be hardy in Denver and are thus grown as annuals. We did mulch some of the groups, however, to see how they might survive the winter under such conditions (see "Plant Portraits" for more on these two stunning annuals.)

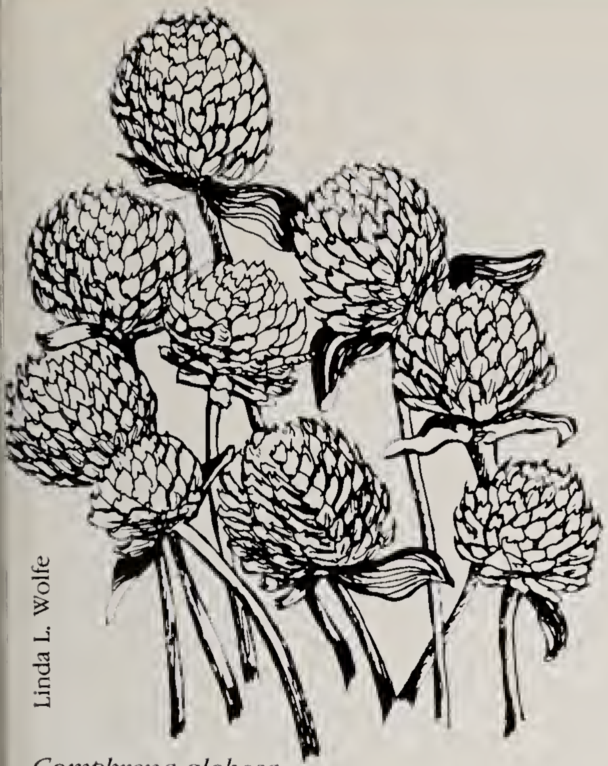
Large baskets of fresh blue ageratum 'Cut Wonder,' geraniums including the ivy geranium 'Decora Lavender' (*Pelargonium peltatum*) that we used in the pergola and home demonstration garden in 1990, the smaller-flowered petunia 'Azure Pearls' and trailing *Vinca major* will enhance the beauty of the gift shop overhang. Over the wall, to the east in the sunken garden, heliotrope 'Dwarf Marine' did extremely well last year and will be repeated. Likewise the eye-catching morning glory vines (*Ipomoea purpurea*) on the gazebo to the west of the main water pool will be retained. Be prepared for a wealth of ornamental grasses among the various displays — they are in fashion. Some will be strictly annuals while others are perennials used for annual effect.

We always take the opportunity to be somewhat experimental with our selections; this is educational for us and all our visitors and in time, some unusual plants may become introductions to the trade. Denver's short frost-free season, good light, moderately high temperatures, low humidity and relative freedom from pests and diseases create an excellent climate for summer annuals. There are plenty to choose at the Denver Botanic Gardens yearly plant sale and in the trade as well. Try to be a little adventurous — you needn't live entirely restricted to the geranium, petunia and zinnia.

Andrew Pierce is Senior Horticulture Advisor at Denver Botanic Gardens. His garden in Evergreen, Colorado was featured in the book *The American Man's Garden*, by Rosemary Verey (Little, Brown and Company, 1990), and also in *Fine Gardening* magazine.


Jill S. Buck

Ipomoea purpurea



Gomphrena globosa

1990 Annual Trials at the Denver Botanic Gardens

by Carol Pelehowski

Approximately one-hundred different annuals were tested in the annual trial gardens at Denver Botanic Gardens in 1990. Plants are evaluated for flower duration and color strength, form, resistance to disease and overall performance.

The fall before the annuals were planted for 1990, well-rotted horse manure was dug into the beds. After planting, the annuals received an inch of irrigation every week, broken into three waterings per week while the young plants were getting established, and then twice a week for the remainder of the growing season. The beds received a broadcasting of granular 8-10-8 general purpose fertilizer three times during this time.

The following annuals are a few of the best from the 1990 annual trial beds at Denver Botanic Gardens.

Helianthus annuus 'Goldburst' was without a doubt the most talked-about new addition to the trial beds. This unique double-flowered sunflower reached a mature height of six feet with the upright habit typical of sunflowers and a spread of approximately twenty inches. The flowers have good gold color and measure six inches across. If you missed this unusual flower in the trial beds last summer, look for it in the 1991 annual display beds.

Helichrysum bracteatum 'Frosted Sulphur' and 'Silvery Rose' proved to be good candidates for future use in the cutting garden. These strawflowers reached a height of fifty-two inches and a spread of eighteen inches. Their long, strong stems make them ideal for cutting and drying. The soft silvery pink combined nicely with the pale cream in an attractive blend.

Although much is written about the All America Selections (AAS), there are two worth mentioning again here because of their superior performance in our trials. If by chance you missed them last year, they will be grown once again in the 1991 trial beds.

Gaillardia pulchella 'Red Plume' (AAS 1991) performed very well throughout the growing season. The two-inch, ball-shaped blooms of rich brick red created a strong mass of color all summer long. Plants were uniform in habit, measuring eighteen inches tall and spreading twelve inches.

Zinnia elegans 'Scarlet Splendor' (AAS 1991) is also worth mentioning. As the name implies, the flowers are bright, true red and measure four to five inches across on strong stems. This upright plant stands thirty-two inches tall, with a spread of approximately twenty inches. Outstanding in both form and color, this annual showed no signs of disease until late August when slight traces of powdery mildew began to appear on the foliage.

Venidium fastuosum 'Zulu Prince' was one of the most interesting plants evaluated in the 1990 trial garden. This member of the Composite family has large, four-inch white daisy-like flowers with showy black centers, yet reached a height of only eighteen inches and a spread of fourteen inches. Look for this unusual plant again in 1991 in the trial garden.

Dahlia x *hybrida* 'Royal Dahlietta' proved to be prolific bloomers. Four of the six colors available of this series were evaluated in the trial beds. Averaging twelve inches tall and wide, these sturdy, compact plants flowered profusely all summer long, even during the hottest periods. These beautiful, reliable plants will be offered at the 1991 Denver Botanic Gardens plant sale.

Carol Pelehowski was formerly Horticulture Assistant at Denver Botanic Gardens. She received a B.S. in Horticulture from Purdue University; she enjoys annuals, and has a special interest in woody landscape plants and cacti and succulents.

Annuals and Biennials for Flower Arranging

by Robin Preston

No two bouquets are ever the same. When I arrange flowers, either for myself or for clients, each creation is unique. The diversity of annuals allows the arranger to explore many moods and themes. Some people prefer a bouquet with a contemporary look—clean, sophisticated and dramatic. Others like a romantic feeling which includes many styles and shapes. We all have occasion for that bold, festive, happy bouquet.

Annuals call to mind bright zinnias (*Zinnia elegans*), airy cosmos (*Cosmos bipinnatus*) and fragrant nicotiana (*Nicotiana alata*)—all the bounty of the summer garden. I think of the seasonal flowers as old friends which appear year after year after a winter absence and I can't wait until the first appear. Some annuals are available almost year-round commmercially, such as stocks (*Matthiola incana*), snapdragons (*Antirrhinum majus*) and blue lace flower (*Trachymene coerulea*) because they are either easy to grow in cool greenhouses or are imported. The annuals that thrive on heat and sunshine, however, are usually available only in spring and summer. Both amateur and professional designers look forward to using their seasonal favorites.

Professional growers take care to cut flowers from the growing fields as early in the morning as possible. For most annuals, the foliage is stripped away from the bottom of the stem which is cut at an angle at the base to allow the maximum surface area for the stem to absorb water. Then the flower is plunged into deep, lukewarm water for an hour or so, after which it is put into a cooler for hardening off. A preservative is added to the water. Anytime a flower is out of water, the stem must be re-cut before it is put into water again.

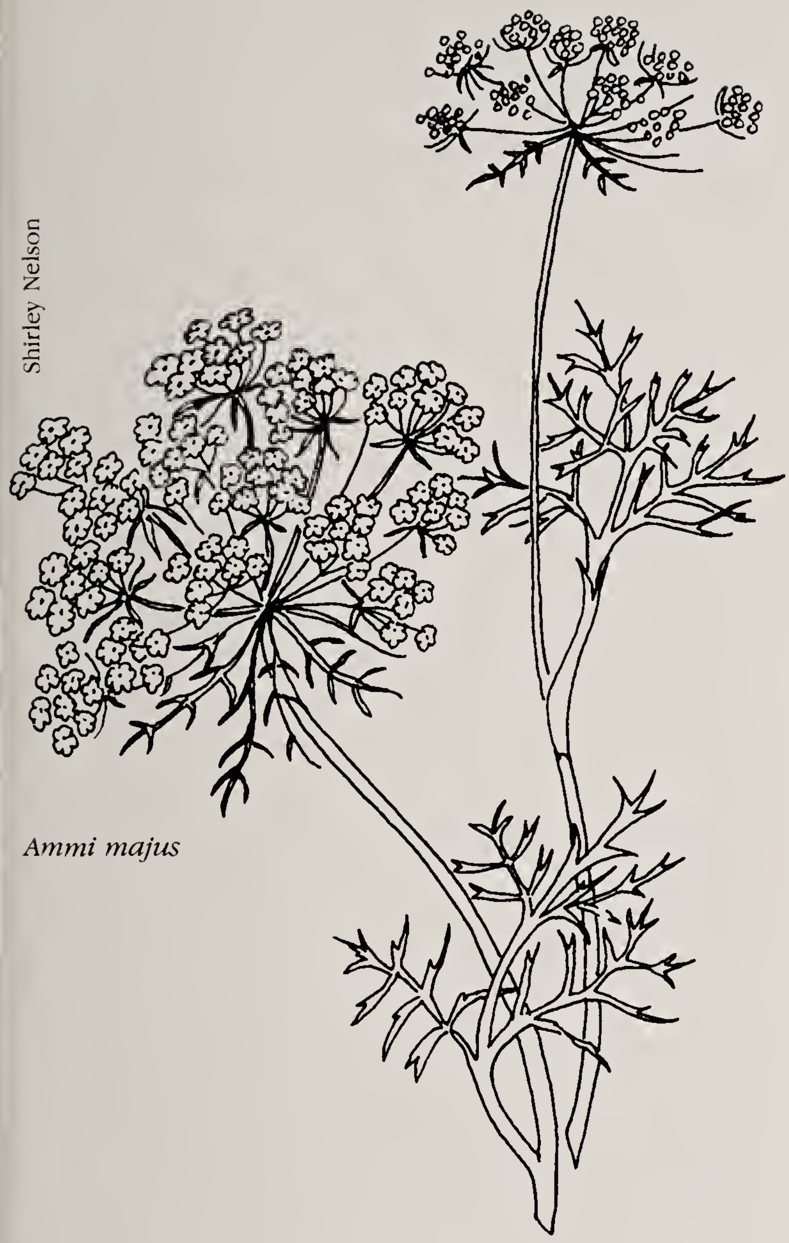
To use a flower for an arrangement to its best advantage, consider its form and color. Some flowers have a naturally old-fashioned air while others possess a stately elegance. There are no strict rules but I think the best designs have a theme or mood.

For a contemporary arrangement, generally speaking, less is more. Think of dramatic lines using twigs, branches or flowers with strong, vertical shapes. Annuals that can give a contemporary feel if arranged simply and sparingly are tall, dramatic foxgloves (*Digitalis purpurea* 'Foxy,' a variety that blooms the first year from seed, while the others are biennial, blooming the second year). Or let a few sunflowers stand alone with very little muss or fuss. Other strong, bold annuals that might be used include the daisy-like gerberas (*Gerbera jamesonii*) and the vibrant red tassels of love-lies-bleeding (*Amaranthus caudatus*). Biennial clary sage (*Salvia sclarea*) has stiff, opalescent flower spikes tailor-made for a simple, clean arrangement.

My favorite theme for arranging is the romantic style, highly versatile and very popular right now. Professional floral designers frequently get requests for these types of arrangements. Terms often used to describe this look are Victorian, English garden, precious, Flemish and loose country arrangements. In this case, more is better.

Queen Anne's lace (biennial *Daucus carota* or annual *Ammi majus*) is the romantic flower arranger's dream. Like the blue lace flower, it is soft and always seems to bend in the direction you want it to go for a magical touch. Nicotiana is great fun. It can keep an arrangement from becoming too rigid. It tends to get away from you, creating an effect that is hard to achieve on purpose. The sweet scent of the white-flowered varieties is an added pleasure. The soft green color of the variety 'Nicki Lime' is unique and invaluable, blending with all colors and bringing out the best in them.

Shirley Nelson



Ammi majus

Other annuals that are perfect for the romantic look are stock for its fragrance and plump, full spikes, long-lasting native prairie gentian, *Eustoma grandiflorum*, with large purple, pink or white blossoms and love-in-a-mist (*Nigella damascena*)—oh so delicate and precious. Others include mallow-cup (*Lavatera trimestris*)—sweet and demure, borage (*Borago officinalis*) with its hairy demeanor, true-blue flowers and lush foliage, and once again, love-lies-bleeding—often a plant can portray quite different moods, depending on how it is arranged and in the company of what other flowers—for its droopy, casual attitude. A large or small overstuffed bouquet, regardless of the theme, relies on diversity of form, texture and color. All of this lushness can be emphasized with grasses and foliage cut from garden shrubs. Foliage is not just a filler. It can be chosen to provide texture and interest. Grasses, twigs, flowering branches and berries add something to almost any bouquet.

Another romantic treat is a bouquet of only one type of flower bunched together and literally packed into a container. I will always remember the time I saw dozens of vibrant home-grown sweet peas (*Lathyrus odoratus*) stuffed into a whimsical collection of containers at a friend's home. The effect was at once unpretentious and stunning. Try for the same effect with other annuals—cosmos, zinnias (incredible color!) or perhaps nasturtiums (*Tropaeolum majus*). Try this simple, natural, yet luxuriant approach now and again—it never fails to delight.

Color can be carefully controlled or totally riotous depending on your mood. A festive theme is fun and the brighter the better. Imagine a bouquet with the bold colors and shapes of gerberas combined with zinnias, dark blue bachelor's buttons (*Centaurea cyanus*), purple globe amaranth (*Gomphrena globosa*), hot pink candytuft (*Iberis umbellata*), bright yellow sunflowers (*Helianthus annuus*) and all shades of asters (*Callistephus chinensis*). This is not a bouquet for the faint-hearted. Bright bouquets help celebrate happy times and they make a great gift for a man. When men ask me to do an arrangement and I have them choose flowers from the cooler or the garden, they seem to choose the brightest, boldest, most off-the-wall color combinations, and oddly enough, to my surprise, the flowers usually come together beautifully. One of my favorite color combinations is orange and pink—different combinations using zinnias, dahlias, sunflowers, celosia (*Celosia cristata*), gerbera, snapdragons and geraniums (*Pelargonium* x *hortorum*) pull this off with panache.

For bouquets of any theme, I like to add blue for contrast and definition. Unfortunately the choice of blue annuals is more limited, but I never tire of larkspur (*Consolida ambigua*), bachelor's buttons, pansies (*Viola* x *wittrockiana*) and sometimes I even stuff in some trailing lobelia (*Lobelia erinus*).

When arranging flowers, I try to remind myself to let go of the rules and overly tasteful restraints and relax. I try to have fun with the containers, shapes and moods. It helps both the arranger and the arrangement to maintain an easy-going attitude towards each creation, be it simple or elaborate. Let yourself discover and rediscover the limitless possibilities the flowers offer, alone or in combination. It is an utter joy to take part in an activity where the natural inclination of the materials used—the flowers—suggest how best to use them. That is what flower arranging is all about—a delicate and pleasurable balance between the hand, heart and eye of the creator and the intrinsic beauty of the plants.

Robin Preston is a floral designer with the shop "Bouquets" in Denver. She has styled arrangements for several books, including *Antique Flowers: Annuals* by Rob Proctor, (HarperCollins, New York, 1991).

Annual Grasses

by Joedy Arnold

Gardeners are always searching for plants that will grow and flourish in difficult situations and remain free of disease and insect attacks. In our region, drought tolerance has become one of the most sought-after traits in plants. Tough, dependable and attractive—this describes ornamental grasses. Using grasses in the garden is not new, although the recent flurry of interest in them might have one believe they were just discovered.

Perennial grasses have fallen in and out of horticultural favor in the United States throughout this century. Annual grasses, on the other hand, have never been extensively available. In 1912, Boddington's Spring Garden Guide listed 20 types of grass seed. Included were three annual grasses: *Agrostis nebulosa* (cloud grass), *Briza maxima* (large quaking grass), and *Pennisetum longistylum*. In garden literature and in American landscapes, perennial grasses have consistently dominated the annuals.

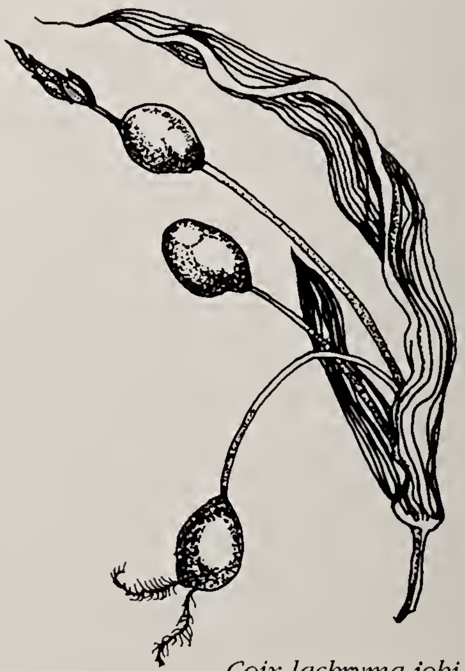
As I have become more familiar with the seldom-mentioned annual grasses, I realize that they, although perhaps a tad less dramatic than their perennial counterparts, are just as striking and full of movement. My interest in annual grasses began eight years ago. I was desperately looking for something new to add to the collection of plants offered in the children's section of Denver Botanic Gardens annual plant sale. I had already ordered the tried-and-true, easy-to-grow flowers of every color, all the vegetables Peter Rabbit liked, plants attractive to butterflies, flowers to dry, herbs to pinch and smell, and so on. I wanted something new. So, through page after page of catalogs, I searched for "child-appropriate"plant names—sweet dumpling squash, rattail radish, bumble bee beans. . . . And there I found hare's tail grass, squirrel's tail grass, foxtail millet—that started it all. I ordered.

The sweet dumpling squash sold. Peter Rabbit's vegetables were a great success. But the hare's tail and squirrel's tail grasses were not a hit. Unable to bear the failure of my new finds, I bought the remaining plants. I simply loved the new garden additions.

Originality when selecting plants often pays off, but design skills are needed to create a truly beautiful garden. It took several years of experimenting before I found good plant combinations for my grasses. In general, annual grasses need no special care. Ordinary soil and full sun to light shade are all most of these undemanding plants require. Many tolerate quite a bit of drought.

Annual grasses are not grown for their foliage, which often looks unkempt and a bit weedy. It is their flowers and seeds that earn them their place in the garden, from the rosy-red panicles of ruby grass (*Rhynchelytrum roseum*) to the pale green and ivory plumes of hare's tail grass (*Lagurus ovatus*). Some annual grasses flower profusely for only a short time and then quickly turn brown and die. These short-lived types include cloud grass, little quaking grass (*Briza minor*) and Canary grass (*Phalaris canariensis*). They need to be carefully combined with other plants to offset their shorter period of attractiveness.

The longer-lasting annual grasses offer a wide variety of colors and textures. Incorporating them with other annuals, perennials or shrubs is a challenge, but when successful, can be strikingly effective. In 1988, a marvelous display at Denver Botanic Gardens combining fountain grass (*Pennisetum setaceum*), pink-flowered ruby grass, white *Nicotiana sylvestris* and the purple, pink and red foliage of Joseph's coat (*Alternanthera ficoidea*) stopped traffic. The foliage of fountain grass is gracefully narrow and mounded, remaining attractive throughout the growing season. In late summer the flowers, 10″ spikes in pink and mauve, begin to bloom. They make excellent cut flowers, but shatter easily when dry. Ruby grass can reach three to four feet in height. Its airy, rose-colored panicles are effective from July into October.



Mary Beth Vogelzang

Coix lachryma-jobi

Pennisetum setaceum 'Rubrum' and 'Cupreum,' with leaves a deep wine red, also give outstanding color over a long period of time. Feather top (*Pennisetum villosum*) is also a long-lasting annual grass. Last year at the Gardens, a solid wave of feather top accompanied visitors along the path on the south side of the conservatory. Red cannas (*Canna* x *generalis*), geranium 'Sincerity' (*Pelargonium* x *hortorum*) and *Salvia farinacea* 'Victoria' were spotted throughout. Pansy 'Black Devil' (*Viola* x *wittrockiana*) appeared at the edge. It was exhilarating to walk the path with all its motion and shifting colors and light. Grasses make a garden come alive.

Both feather top and *Pennisetum setaceum* make great container plants. In large, square wooden planters, combined with small tufts of perennial blue sheep's fescue (*Festuca ovina var. glauca*), the grasses create a simple, soft feeling. The huge, nine-inch red, rose or white flowers of the *Hibiscus* 'Disco Belle' series make them difficult, domineering plants to mix in the garden. In a pot they look less out of place; in the garden, with graceful feather top as a foil, they are smashing.

A late-summer combination that works well in my garden allows perennial mugwort (*Artemisia lactiflora*), four-foot tall with fragrant ivory flowers, to mingle with the creamy plumes of feather top. The late-blooming, deep blue flowers of tall, tender perennial *Salvia guaranitica* are set off beautifully by the creamy mugwort and grass.

The best annuals to combine with grasses are often the more open, natural-looking ones. They blend easily, contributing to the spontaneous, easy feeling grasses give a garden. This mood, evocative of the prairie, was exemplified last year by the lovely planting on the south berm in the Hildreth garden at Denver Botanic Gardens. There, *Pennisetum setaceum*, ruby grass, *Rudbeckia hirta* 'Irish Eyes'—a green-centered version of black-eyed susan—and creeping zinnia 'Gold Braid' (*Sanvitalia procumbens*) mingled with the purples of tall, airy *Verbena bonariensis* and shorter *Verbena rigida*. This drought-tolerant gold, mauve and purple composition mirrored the colors that dominate the grasslands in summer and fall.

I have found that several of the medium-sized annual grasses, especially foxtail grass (*Setaria lutescens*), mix wonderfully with native goldenrod (*Solidago spp.*), blue sage (*Salvia farinacea*), gold and maroon calliopsis (*Coreopsis tinctoria*) and the rose-crimson flowers of Mexican sage (*Salvia greggii*). In the shorter part of this bed, I grow mahogany and gold miniature marigolds (*Tagetes tenuifolia pumila* 'Tiger Eyes' and 'Star Fire') and *Zinnia elegans* 'Old Mexico,' which mirrors the marigolds' colors. Squirrel's tail grass (*Hordeum jubatum*), with its silky, light-catching flowers twisting and turning, softens the colors and textures of the annual flowers.

Some of the larger grasses need bold companion plants. Black millet (*Sorghum bicolor*), a giant at eight to ten feet tall, makes mighty clumps of straight, strong stems—highly architectural. Ornamental corn (*Zea mays*) is similar in effect, although somewhat shorter. Its leaves are gaily striped with pink, yellow and purple, beckoning for imaginative companion plantings that pick up on these colors.

I interplant a perennial thicket of Jerusalem artichoke (*Helianthus tuberosus*) with tall annual grasses and annual sunflowers (*Helianthus annuus*). Sunflowers, quite drought-tolerant and very easy to grow, now come in varieties with more elegance and suitability for cutting than the original form. 'Color Fashion Mix,' offering a wide range of flower colors from deep gold to the palest yellow and including burgundy, brick red and bicolors, provides excitement before the Jerusalem artichokes bloom. 'Luna,' a 5-foot, branching variety bearing pale yellow flowers with chocolate centers, or the most manageable sunflower, 'Piccolo,' at only four-feet and covered in small black-eyed flowers, are two other options.

My favorite annual grass is little *Lagurus ovatus*, hare's tail grass. How terribly it has been misused; it cuts and dries so well that it has become known more for dying the flowerheads electric pink, green or yellow than growing them in the garden. Children love to touch the soft, yet firm little "hare's tails." Hare's tail grass should be planted in drifts for the best effect. It mingles well with little Swan River daisy (*Brachycome iberidifolia*), dwarf larkspur (*Consolida ambigua* 'Dwarf Hyacinth'), *Cosmos sulphureus* 'Sunny Mix, ' *Chrysanthemum carinatum* 'Court Jester' and *Chrysanthemum coronarium* 'Primrose Gem,' two colorful annual mums, among others.

Older garden books repeatedly say annual grasses belong only in the cut flower or vegetable garden; newer publications ignore the annual grasses while inspiring the perennial lover. It's about time we made room, even in the smallest garden, for both flowers and annual grasses, and together, not separate. The real fun lies in choosing the combinations.

A short description of 13 annual grasses follows:

Agrostis nebulosa (cloud grass)
8-20″, blooms June through July, sometimes into August. Loosely-tufted grass with sparse foilage, slender leaves, leggy stems. Large delicate, cloud-like clusters of flowers are good for cutting and drying but not dyeing. Dies quickly after blooming. Well-drained soil, sun or light shade. Germinates in three weeks when sown outdoors.

Briza maxima
(puffed wheat, large quaking grass)
1-2′, blooms mid-June through July for 6-10 weeks. Loosely-tufted annual grass, can be a bit ungainly and reach 3′ with extra water and rich soil. Foliage of medium texture, light green maturing to straw yellow and finally rich brown. Flower spikelets are pale green to purplish green and wave and bob in the slightest breeze. When dry, the panicles of florets rattle nicely if left in the garden and are equally suited to drying and dyeing. Pick the panicles before the florets open. Dye them in a hot water solution. Germinates in 10-14 days if sown indoors, can be sown directly in place. Well-drained soil and full sun.

Briza minor
(little quaking grass, lesser quaking grass)
6-18″, blooms 4-6 weeks sometime between June and September, usually just as *B. maxima* has finished. Dies shortly after flowering. Charming 2-4″ light green panicles of heart-shaped florets make this a good grass for cutting and drying. Botanical variety *B. minor* var. *minima* stays 6″. Fertile soil, full sun, not drought-tolerant. Is flattened by heavy rain, wind or forceful hosing.

Bromus lanceolatus (*B. macrostachys*)
(brome grass)
2′, blooms mid-June through mid-August for 6-10 weeks. Other species of brome grass are noxious weeds. This densely-tufted grass has an erect, 4-7″ spiky inflorescence, with showy slender bristles. It starts off pale green, turning beige with age. Difficult to dry but very beautiful. Full sun, average moisture. Sow direct in spring.

Coix lachryma-jobi (Job's tears)
3-4′, insignificant spikelets followed late in the summer by showy, hard, bead-like fruits. Fruits start green, turning shiny greyish-mauve in the fall, and finally nearly black, contrasting nicely with the broad, flat, stiff leaves. Fruits have been used for jewelry and rosary beads for centuries. In the Orient, seeds are ground into flour. Best to start as plants since it takes a long season to ripen the seeds. Grow in part shade with ample moisture for best results. To hasten germination, soak seeds in water for 24 hours before planting.

Hordeum jubatum (squirrel's tail grass,
foxtail barley)
20-30″, blooms early June through July for 6 weeks. Open-tufted short-lived perennial or annual grass. Feathery, plume-like flower spikes can be green, dark red or purple, and twist and curl. Pick before fully mature for fresh arrangements; they shatter easily when dried. Full sun, moist or dry soil. Bristles cause problems in livestock, which has led to the ban of the grass in certain regions.

Lagurus ovatus (hare's tail grass)
10-20″, blooms June through August. Loosely-tufted grass with dense, pale-green flower spikes that do not shatter with age. Foliage is attractive pale greyish-green. Stems and leaves soft and downy. Full sun or light shade with average moisture for best flower production; tolerates drought. Easy to grow, can be sown directly.

Phalaris canariensis (Canary grass)
2½′, blooms June through mid-August. Tufted annual grass reaching 4′ in optimum conditions. Flower spikes variegated green and cream, good in dried bouquets, difficult to dye. After flowering, plants decline rapidly. Widely cultivated for birdseed for wild and domestic canaries. Often grows at the dump where the papers lining the bottom of bird cages end up. Full sun, well-drained soil, average moisture. Self-sows readily.

Pennisetum setaceum (*P. ruppelii*)
(fountain grass)
2-3′, blooms late July through October for 10 or more weeks. Similar in size and habit to the perennial Australian fountain grass, *Pennisetum alopecuroides*. Forms graceful, fine-textured, arching mound, very useful in softening harsh areas such as paths, driveways and walls. Flowers 8-10″ long, narrow, rose-colored panicles, great for fresh flower arrangements. Full sun to light shade, ordinary garden soil. Varieties 'Rubrum' and 'Cupreum' have broader leaves and are more upright. 'Rubrum' has rose-purple leaf-blades and flowers, 'Cupreum' red-brown foliage and coppery flowers.

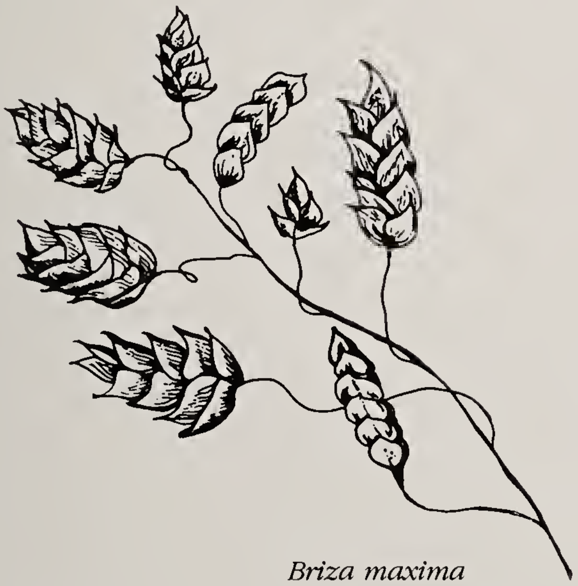
Pennisetum villosum (*P. longistylum*)
(feather top)
1½ — 2½′, blooms mid-July through late September. A short-lived perennial in warmer climates. Green, medium-textured, mounding foliage. Numerous flowers are quite heavy and arch and droop, producing a graceful effect. Feathery bristles on the pale-green to white, 3-5″ long flowers give them a feathery appearance. They turn buff with age. Full sun to light shade. Fertile soil and average moisture produce the best plants, yet feather top can tolerate some drought. Easy from seed started inside or sown outside when the ground is warm.

Rhynchelytrum repens (*R. roseum, Tricholaena rosea*) (ruby grass, Natal grass, champagne grass)
2-3′, blooms mid-July through early October, for about 10 weeks. Loosely-tufted, upright annual grass, perennial in warmer climates—in the South, especially Florida, it has naturalized along the highways. Green leaf blades about 1″, flat and tapered to a point. 6-10″ ruby-red flower heads turn pink and finally silvery white over a long season of attractiveness. It is excellent for fresh arrangements—pull the stem out of the leaf sheath rather than cutting it when harvesting. It loses its color rapidly and shatters when dried. Stems root if the nodes touch the ground. Offsets

can be detached and potted up, grown in a cold greenhouse over the winter and planted in the garden the following spring. Full sun, well-drained soil. Ruby grass is heat- and drought-tolerant.

Setaria italica (foxtail millet, Italian millet)
3′, blooms mid-June through August. First grown in ancient China in 2700 B.C., where it was considered sacred. In China today it is a major cereal crop. During the Middle Ages, it was cultivated as a grain in Europe; presently it is an important source of birdseed. Foxtail millet's 3-7″, loose panicles of white, cream, yellow, red, brown or black flowers turn golden tan in late summer. Sun to light shade, ordinary garden soil. Can take light drought. Easy from seed sown directly in spring.

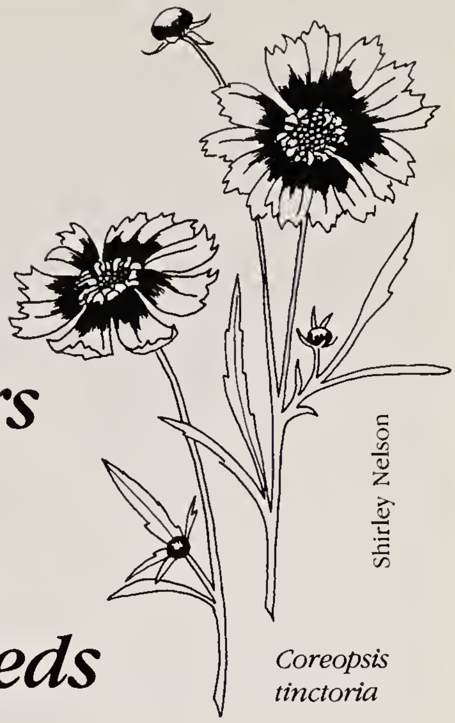
Sorghum bicolor (*S. vulgare*)
(great millet, dari, durra)
8-10′, blooms in the summer, inconsequential—seed is decorative. Sorghums have been used since prehistoric times. The juice of the stems is used to make molasses, syrup and an alcoholic drink. One variety is made into flour, another is grown for silage and fodder for cattle. The dried panicles of another are used for brooms. 2′-long leaves are light green with specks of brown or curry and make excellent additions to the flower arranger's palette. The shiny black seed panicle is loosely formed, varying in size and shape. It starts off erect, becoming more pendulous as it ripens. Often green, white and pink grains are mixed in with the black and brown ones, making the panicle a prime candidate for fresh arrangements as well. The seeds fall out quickly, so drying is not as successful. Full sun, ample moisture. Do not set out until all danger of frost is past.


Mary Beth Vogelzang

Briza maxima

Joedy Arnold is one of the 12 founding members of the original Denver Botanic Gardens volunteer group formed 30 years ago. As head of the annuals division of the Gardens plant sale, she offers over 500 species and varieties of annuals each year, making the sale one of the best retail sources for unusual annuals in the country.

Volunteers Benefit Denver's Flower Beds


Shirley Nelson

Coreopsis tinctoria

by Amy Pulver

Denver's nationally recognized city flower beds have been admired by visitors and loved by Denver residents for one-hundred years: 1990 was their centennial anniversary. During the past three summers, some of these flower beds have received an extra dose of tender loving care from participants in Denver Parks and Recreation's Volunteers in Parks (VIP) program.

Denver Parks and Recreation employees prepare the beds, plant the flowers and then work with VIPs to provide training, answer questions and ensure the work is accomplished regularly. VIPs weed and cultivate the beds, pinch back the plants and remove spent blossoms. The success of the program has led over the past few years to include beds in Observatory Park, Huston Lake Park, Pinehurst Park, Seventh Avenue Parkway and Rosamond Park.

The various VIP groups organize their efforts and volunteers differently. In Observatory Park, for example, families sign up for maintenance duties for several days or a week during the summer months, while in Huston Lake Park, the entire group convenes regularly and works together. The beauty of the program is that it can be designed to fit the needs, demographics and work patterns of each participating neighborhood, making it a rewarding and enjoyable experience for participants of all ages while beautifying Denver for everyone.

Since 1989, more than one-hundred volunteers have participated and the potential for expansion is nearly limitless. For additional information, contact Volunteer Program Administrator Delaine Deal at (303) 458-4794.

Amy Pulver is Director of Communications for Denver Parks and Recreation.

The Garden-less Gardener: Containers to the Rescue

by Tom Peace

Container gardening is the most versatile way of bringing plants into your life. Some of these serve as portable gardens, grown in anything from clay flower pots to whiskey barrels; others are as large and esoteric as the rare case of a swimming pool filled in and planted after the owner grew tired of pool maintenance.

Although gardening in containers is the logical solution to a shortage of real garden space, it is also the best approach for would-be gardeners with lots of space but no real soil. Many gardeners have experienced the agony of trying to plant flowers and vegetables in ground more suited for making bricks or being a driveway. And while almost any land can be amended and worked into viable and vital soil, it is definitely easier to fill a pot with a particular mix and plant in that.

Necessity is not the only reason to delight in container gardens. Even an established garden can use well-planted pots and boxes. Many excellent perennial borders and landscapes are enhanced by potted blooms on the terrace; they add a cohesive, integrating element between the natural part of the garden and the non-living landscape—the paths, patios, terraces—near the house.

One of the advantages of pot culture is the ability to move containers and redecorate the terrace, balcony or patio for parties, on a whim or, as the weather cools, to bring favorites inside for prolonged bloom. Again, if the containers are light-weight, the task of moving them about will be so much easier. Therefore, try to fill the bottom portion of especially large pots with something light so that only twelve to fifteen inches of soil mix are needed to fill the pot to just below the rim. At last there is a noble use for those styrofoam packing bits. Bark can also be used, as well as tree leaves from last fall's pile, or even emptied, inverted six-packs from store-bought annuals. With large containers offering greater opportunities for garden design and more of an impact on an area than smaller ones, it's nice to know the entire garden allowance needn't be spent on the soil to fill them.

The most important consideration for the planted container is size. Small pots dry out rapidly in our hot, dry summers and the joy of gardening will quickly diminish if you are forced to water several times a day. To avoid this and reclaim the summer for more engaging activities, don't plant any pot less than six inches deep and ten inches in diameter (eight inches in diameter if in the shade).

However, if you find the perfect urn and it happens to be on the small side, don't hesitate to fill it with geraniums (*Pelargonium* x *hortorum, P. peltatum*) or trailing verbena (*Verbena* x *hybrida, Verbena tenera*), or a few of the other, more drought-tolerant annuals. There are several that tolerate frequent drying out and still look quite pert. Larger pots will offer a more constant growth environment for those flowers and plants without a cast-iron constitution.

The choice of container is a combination of imagination and resource, artistry and budget. While I wouldn't reject outright any container chosen by the creative gardener, I will say that the "tulip-cut" old tire could be laid to rest for a while. I admit to the fantasy of antique claw-foot bath tubs brimming with brilliant blue, red and pink flowers of de Caen anemones (*Anemone coronaria*), so I know how easy it is to cross the fine line that separates the unique from the absurd.

Let your imagination run wild even if your wallet cannot, but don't be too timid to consult a friend for artistic advice. Terra cotta pots can be expensive in the larger sizes, although their familiarity is soothing. Storing them in a dry place away from extreme temperature changes during the winter will help them last for many years. Baskets, brass, wood, glass or even plastic with a coat of special spray enamel that adheres well are just a few of the materials possible.

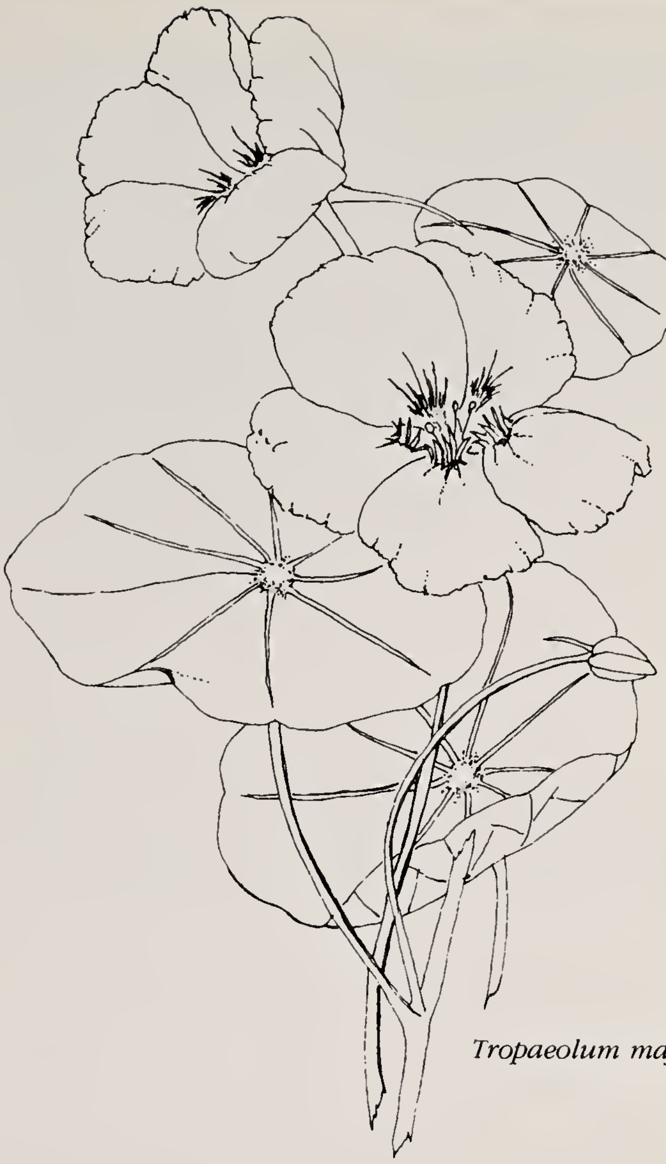
Once the containers are selected, it's time to fill them. There are many potting soils and soil-less mixes from which to choose; some gardeners mix their own. When I mix mine (I feel that paying for soil is like buying sunshine or air) I start with a good garden loam or sandy loam and add perlite or vermiculite in equal proportions. The suffix these latter two ingredients share is key here—"lite," even if misspelled, since the finished container should be more easily and painlessly moved to any of several locations during its life. I also add organic matter in the form of leaf mold, compost or peat moss in the same volume as the soil so that the resulting mix is one-third soil, one-third "lite" ingredients and one-third organic matter.

Whether you are going to landscape with your miniature "gardens" or just embellish a spot, start by looking at where the container will go before you plant it. The site will dictate both what can be grown as well as what plants will look best in terms of color, size, form and texture. Always ask yourself, "what will grow here?" as a first step so you don't end up with tender shade lovers frying on the sunny south-west patio while the sun- and heat-loving plants languish under the cool shade of the maple tree. The right plants in the right place will result in reliable performance all summer long, barring heat waves and hail storms.

A few artfully placed pots combining airy asparagus fern (*Asparagus densiflorus*), blue and white trailing lobelia (*Lobelia erinus*), yellow-leaved coleus (*Coleus* x *hybridus*) and variegated trailing vinca (*Vinca major* 'Variegata') will create a cool, breezy ambiance on a shaded terrace. In an east-facing area, sheltered from the hot afternoon sun, try a few white planters filled with simple yet lush Martha Washington geraniums (*Pelargonium* x *domesticum*), whose flowers resemble the most beautiful azaleas. Just as easily a sultry tropical garden tub can be created with dramatic red-leaved castor bean (*Ricinus communis*) and cannas (*Canna* x *generalis*), hot-colored hibiscus (*Hibiscus rosa-sinensis*) and yellow lantana (*Lantana camara*) glowing on a hot, sunny patio (provided the container is large enough to be kept evenly moist).

I do not mean to ignore petunias (*Petunia* x *hybrida*), pansies (*Viola* x *wittrockiana*) or geraniums and the like. Rather, many of the delightfully-colored hybrids of these old standbys, when grown and displayed in pots, become visually revived and invite reveling in their colors, singly or in combination. I particularly love a basic terra cotta pot overflowing with plum or burgundy petunias, or a bright mix of festive nasturtiums (*Tropaeolum majus*) trailing over the edge of a clay azalea pot.

I am also fond of raucous, gaudy palettes for a splash of contemporary landscape color. Somehow floral combinations that in the border might call to mind a velvet painting, leap to acceptable and exciting heights as containerized compositions. The exuberance of plant color, form and texture is celebrated in the confines of a tub as purples, yellows, reds and oranges consort like the notes of the Hungarian Rhapsody.


Marilyn Wilson

Tropaeolum majus

I recommend including at least one type of non-blooming plant in the combination for foliage appeal. It may seem a loss to forego the unabashed verve of a flowering annual for something more subtle, but the subdued effect of foliage color and form works wonders in containers, just as it does in the garden. One of my favorite ensembles includes yellow and burgundy coleus and silver dusty miller (*Senecio cineraria*) around a dracaena (*Cordyline indivisa*) spike with an edging of lacy lobelia trailing over the edge. Garden perennials and herbs can also be used for foliage effect, such as variegated ribbon grass (*Phalaris arundinacea* 'Picta'), blue fescue (*Festuca ovina var. glauca*), bergenia (*Bergenia cordifolia*), hosta, lavender (*Lavandula angustifolia*), scented geraniums (*Pelargonium spp.*) or rosemary (*Rosmarinus officinalis*) to name just a few.

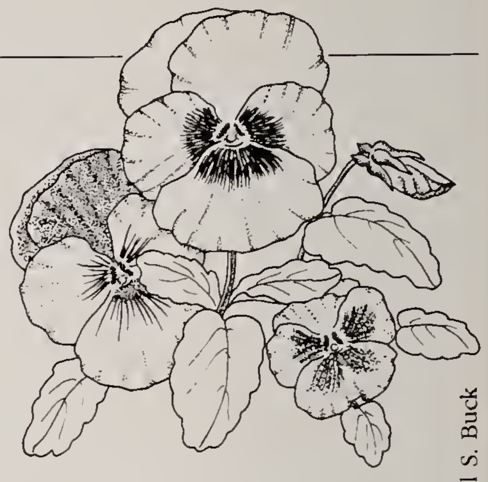
A cool look for a hot spot might include blue fescue with grey-leaved lavender and lacy dusty miller backed by white geraniums. This collection would also tolerate considerable drought. For a simple urn in light shade, combine bergenia or hosta with large-leaved dusty miller, ribbon grass and either white or pastel impatiens (*Impatiens wallerana*) or pansies. Variegated geraniums are a valuable addition to a container garden even if they refuse to bloom. The mottled tropical foliage of the white or yellow summer callas (*Zantedeschia albomaculata* and *Z. elliottiana*) is also stunning in a pot, even after the showy blossoms fade.

When springtime enthusiasm and available space allow for a vast array of potted possibilities, the big landscape picture should be kept in mind. Allow for different themes to develop in certain areas, encouraging this by the repetition of certain forms, colors, textures, and particular plants. This will also successfully harmonize an otherwise hodge-podge collection of containers. By establishing a rhythm of color or form, for instance by repeating a favorite accent plant in every pot, a unified, harmonious and beautiful container landscape emerges. No gardener need remain garden-less.

Colorado State University-trained Tom Peace is a freelance landscape designer in Colorado and Texas. He was a wholesale grower for the florist trade for seven years; he especially enjoys growing unusual plants and has had great success pushing the limits of hardiness.

For the Love of Cut Flowers: An Annual Ritual

by Diane Ipsen



Viola x *wittrockiana*

Jill S. Buck

Chryse Hutchins just loves it when Valentine's Day is over. Not that she's unsentimental or abhors boxed chocolates. It's just that that's when she "knows it's coming." Chryse is referring to the long-awaited annual event of planting her cutting garden, and she speaks of this with a passion in her voice that might be reserved for an upcoming trip to Tahiti or at least the end of the school year (she is a teacher). But for this amateur gardener, like so many others, it is the anticipation of the cherished rituals that come with the gardening season that quickens her pulse in February.

"The process is such an important part of it. That's what I love as much as anything," she says with fervor.

There is, first of all, Making the List. Then comes the Search: snooping around in all the garden centers. "I have certain places I go for each variety—and I have all these memories—like when I go to Evergreen's Half Acre. I love going there when there's a big thunderstorm—I just hope that I'll hit it each year because I remember the feelings of being in that place—that's not really an indoor garden, it's kind of outdoors as well. . . And, you know, the canvas flaps are blowing. . ." She trails off, in a reverie, lost among the bedding plants in a rainstorm.

"And that is part of the whole ritual of all this. I don't know. . . I do this every year, and I bet I spend over $400—easily. But, you know," she laughs, "it's cheaper than a shrink."

Chryse would be the first to admit that her garden has little winter interest. Few perennials are visible in early spring for she reserves almost every inch of garden soil for setting out bedding plants in May. The reason she has dedicated her garden to annuals is that one of her deepest satisfactions in life is to arrange great bunches of homegrown flowers in every basket, bowl or vase she can get her hands on and give them to her lucky friends. When you have as many friends as Chryse has, this requires a bounteous crop of flowers for cutting all summer long and that means planting mostly annuals. Chryse Hutchins is a gardener with a purpose.

"I'm real funny about all of this; I know exactly what I want. I'm not very adventurous," Chryse protests in defense of what she considers to be her modest palette of bedding plants. "But everything I plant, I plant to cut. I don't plant for it to look aesthetic." That means three criteria must be met for a flower to earn its keep in this garden, where space and sun are at a premium: the color, a good stem, and its staying power in a bouquet. (The exception is electric blue lobelia (*Lobelia erinus*), which Chryse must have in the garden, though she doesn't use it for cutting.)

"The main thing I plan all the other flowers around in an arrangement are the dahlias, which are wonderful cutting flowers," says Chryse. She only grows the big types, buying them as large plants in May—and she doesn't dig the tubers up in fall as many gardeners do. "The seed dahlias are okay for an arrangement, but the stem isn't long enough," she says. "If a stem is too short or hairy, that's bad."

Besides dahlias, her not-exotic-but-reliable regulars for cutting include bronze French marigolds (*Tagetes patula*), pink and white nicotianas (*Nicotiana alata*), zinnias (*Zinnia elegans*), cosmos (*Cosmos bipinnatus*), impatiens (*Impatiens wallerana*), pansies (*Viola* x *wittrockiana*), and her favorite — 'Little Darling' snapdragons (*Antirrhinum majus*), a semi-dwarf variety. "I just adore them. In an arrangement, they are so precious; people ask: 'what *is* this?' They look just like a little rose — and they won't flop over when it hails or storms. I buy several flats of 'Little Darlings' and if I keep them cut and fertilized, I can get three big harvests — but that variety can be a little harder to find."

Chryse may call herself "unadventurous" but every year she initiates something new. Last summer she had high expectations for *Nemesia strumosa* and planted all the colors: orange, yellow, pink and deep pinkish-purple. But nemesia didn't perform well in partial shade, and Chryse feels it needed a sunnier location. Even though she fed the plants regularly, the ingrates quit blooming. Stocks (*Matthiola incana*) were also allowed into the club but they behaved themselves, contributing a spicy fragrance to her bouquets and proving to be long-blooming. ("In fact, at Thanksgiving I still had some going out there.") She minces no words in reviewing the performance of her third provisional plant: she hated gazania. "That should remain *in* your garden — it should not ever be cut!" she warns, still wounded by its betrayal. Blossoms of *Gazania rigens* close up with shade, so of course they exhibited that cantankerous habit in her flower arrangements as well.

According to Chryse, upcoming summer experiments may include perennial *Salvia* x *superba*, white coralbells (*Heuchera sanguinea*) and hollyhocks (*Alcea rosea*), which she thinks are regaining popularity because they remind people of the past.

Another old-time favorite making a come-back is feverfew, which Chryse discovered last summer. Passionate gardeners become keen observers of any new developments on the local horticultural scene. On her daily walks, Chryse kept noticing a white chrysanthemum-like flower growing in neighbor's gardens. Checking around, she found out it was *Chrysanthemum parthenium* 'White Stars' — sometimes sold as *Matricaria* and grown as a half-hardy annual. "The reason I'm so excited about this plant is that it's white. I have so much pink and yellow in my garden that I love finding anything that's white. It's charming in arrangements and it has such a long blooming season!" Feverfew definitely made it into the inner sanctum.

"After the daisies go, petunias and nicotianas are the only white flowers that are left. And white dahlias. I need to find more white annuals! I noticed that I didn't have enough white so this past year I tried white gerbera daisies (*Gerbera jamesonii*), but they only produced one or two flowers the whole season. They're gorgeous when you get one. They'll last two weeks."

Gardening snobs may thumb their noses at petunias, but Chryse finds 'White Cascade' provides a terrific source of the long-lasting white blossoms she finds difficult to keep stocked. Another petunia Chryse favors is 'Midnight' which sports streaks of deep purple against white and has a longer stem.

Chryse understands that variety in flower form and size is essential to the beauty of a bouquet. She lists her perennial coralbells and pink veronica (*Veronica spicata*) along with annual blue *Salvia farinacea* as favorite flower forms to spray out from an arrangement and contrast with rounder flowers. But flowers don't compose the whole picture either. Some of the most important plantings in Chryse's garden are the annuals she grows for foliage: dusty miller (*Senecio cineraria*) and pink-tinged varieties of coleus (*Coleus* x *hybrida*) — for she has a very defined method when she sets out to arrange a basket of cut flowers. "I like to separate flowers by color; I usually don't put pink next to yellow — that's real important to me. Instead, I separate colors with dusty miller or coleus. I just love how it frames the flowers! Or I use white nicotiana and put colorful flowers around it."

Her fascination with arranging flowers began quite casually, back in the days when Chryse was still trying to figure out how to reconcile a rambunctious Labrador retriever, a free-roaming pet rabbit and a garden of flowers. She created some modest centerpieces and shared them with friends. Recipients got hooked. Soon she was urged to offer her bouquets as an item for bid at the annual fund-raising auctions at her children's schools. Chryse offered one flower arrangement a month for June, July and August and it prompted a generous bid. Now she offers two such packages. "I realize how much joy other people received from my doing that," she says with honest amazement.

Surprisingly, Chryse seldom uses fresh flowers in her own home. "I give them all away. It's just more fun to make sure someone is at home, drop them off and say 'Enjoy!' It's really a kick for me. . . Some people say: 'Oh Chryse, I tried to get your flowers at the auction this year and I was outbid so I put those people on my list too. Sometimes a friend will call and say: 'you told me to tell you this, but we're having a dinner party tonight—would you mind?' And I love that!" Throughout the summer, she bestows her flower arrangements at the rate of three a week—which should just about qualify her for Fairy Godmother status.

"Oh, but the planning is great—the ritual of going out every morning with my cup of coffee and kind of planning: 'Well, if I wait two more days I'll have a purple-white dahlia and an all white dahlia' and then watching to see what other things would be available to fill in. . . and not taking too much of the coleus for this particular bouquet and leaving it for another one down the road."

But for Chryse the optimal experience, the harmony and connectedness that accompany a state of focused concentration, comes with the creative act of making the bouquet. "I just love having all my flowers laid out on the kitchen counter, and standing back, and putting them in the containers, and looking at them—I just love that feeling. . . and then they're there and I think: 'Who can I give these to today?' It's a total escape; flower arranging does that for me. I can let the dinner burn. . . I don't feel guilty about doing that because I feel so fulfilled when it's over. I've never read a book about flower arranging—I probably should. I've never taken a class. People say, 'How'd you learn to do this?' I don't know if they look good or not—but I just feel so much better when I'm all done!"

"Everything that I've learned has been through trial and error or standing for hours and reading signs in garden centers and asking salespeople questions. That's how I've learned everything—just reading all those signs and thinking of trying these things out. It's been kind of my own discovery process, which I like about it."

Chryse continues, "It's such a different approach from what I use with my job [as a writing teacher for The Denver Coalition and the Stanley British Primary School]. I've read dozens of books and I've attended lectures, taken classes. . . I've done everything I could to find out about the writing process. This [the gardening] is a real personal search."

The question comes up: perhaps we have come to rely too heavily in our culture on the so-called experts—we have stopped trusting (and therefore lost the resulting joy of discovery from) our own first-hand experiences and observations. Perhaps the fascination with and wonderful thing about gardening is that you can try something you're not sure of, goof up, and it doesn't really matter: it isn't a *big* risk—plus, you get to try it again and maybe get it right next year.

Chryse thinks about that for a moment. She still feels she ought to research gardening more in books. "I do need to find more white annuals." She smiles. "But I'm happy with the way it is."

Diane Ipsen holds a master's degree in landscape architecture and her practice focuses on residential design. She emphasizes water-wise landscapes and likes transforming clients into enthusiastic gardeners.

To help solve her problem with white, Chryse was delighted to learn about the many white annuals she could try:

Alcea rosea hollyhock biennial
Ammi majus annual Queen Anne's lace
Ammobium alatum winged everlasting
Argemone platyceras prickly poppy
Begonia spp. begonia
Brachycome iberidifolia Swan River daisy
Browallia speciosa browallia
Callistephus chinensis China aster
Campanula medium Canterbury bells, biennial
Catharanthus roseus Madagascar periwinkle
Centaurea cyanus bachelor's button
Crepis rubra hawk's beard
Chrysanthemum spp. garden mums, feverfew
Clarkia spp. satin flower
Cleome hasslerana spider flower
Consolida ambigua larkspur
Cynoglossum amabile Chinese forget-me-not
Dahlia hybrids
Datura spp. angel's trumpet
Daucus carota biennial Queen Anne's lace
Dianthus chinensis garden pinks
Digitalis purpurea biennial foxglove
Dimorphotheca spp. Cape marigold
Eschscholzia californica California poppy
Euphorbia marginata ghostweed
Eustoma grandiflorum prairie gentian
Gazania rigens treasure flower
Gomphrena globosa globe amaranth
Gypsophila elegans annual baby's breath
Helichrysum bracteatum strawflower
Heliotropium arborescens heliotrope, fragrant
Helipterum roseum strawflower
Hesperis matronalis sweet rocket, biennial, fragrant
Iberis spp. candytuft, fragrant
Impatiens spp. impatiens
Ipomoea purpurea morning glory
Lantana camera lantana
Lathyrus odoratus sweet pea, fragrant
Lavatera trimestris shrub mallow
Limonium sinuatum statice
Linum usitatissimum annual flax
Lobularia maritima sweet alyssum, fragrant
Lunaria annua honesty, biennial
Malcomia maritima Virginia stock, fragrant
Mirabilis jalapa four-o'clock
Myosotis sylvatica biennial, fragrant
Nemesia strumosa nemesia
Nicotiana spp. flowering tobacco, fragrant
Nierembergia hippomanica cupflower
Nigella damascena love-in-a-mist
Oenothera acaulis Mississippi evening primrose, fragrant
Omphalodes linifolia navelwort
Papaver spp. poppy
Pelargonium spp. geranium, fragrant
Penstemon gloxinioides penstemon
Petunia x *hybrida* petunia, fragrant
Phlox drummondii annual phlox, fragrant
Portulaca grandiflora moss rose
Salvia spp. sage
Scabiosa atropurpurea pincushion flower
Schizanthus spp. butterfly flower
Senecio cineraria dusty miller
Torenia fournieri wishbone flower
Verbena spp. verbena
Viola a *wittrockiana* pansy
Venidium fastuosum Cape daisy
Xeranthemum annuum immortelle
Zinnia elegans zinnia

Dressing for Success — Clothing the Garden with Annuals

by Angela Overy

Trees, shrubs and perennials form the skeleton, the bone structure of the garden. I see annuals as the clothes on the body frame, always changeable, providing quick transformations of personality, be it from the boldly glamorous to the elegantly efficient to the dreamily romantic.

Some older gardens have been planned so beautifully over the years that they need only a few little touches of added color here and there to keep them exquisite all summer long. In such gardens, the shrubs, perennials and herbs have been carefully orchestrated over the seasons so that an annual is almost an intrusion into the symphony. There also is often very little spare space.

Few gardeners have worked themselves into this enviable position, however. Even those who have might consider setting aside a small area just for annuals, perhaps in the sunny part of the front yard for a yearly dazzle that you and your guests can enjoy every time you drive up to the house. Such a planting makes a statement, a signature for the home; friends and neighbors will eagerly anticipate arriving at your place to discover what interesting and attractive annuals you have planted this year.

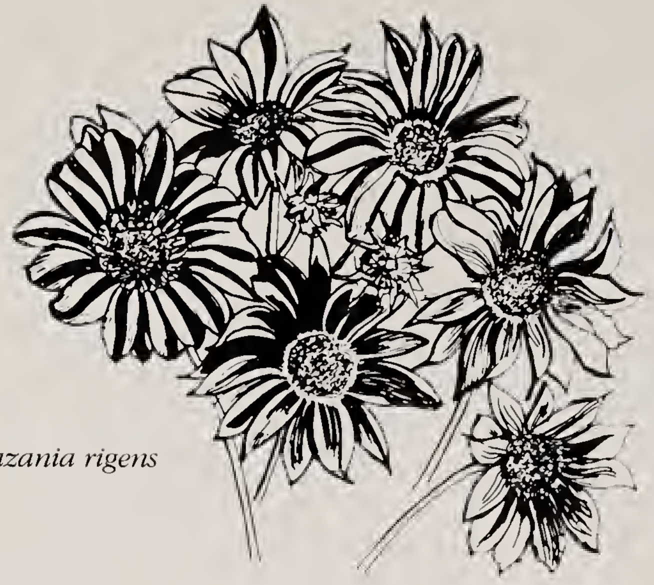
We all fall into habits; it is easy to plant the same geraniums interspersed with the same dusty millers, bright petunias or marigolds, year after year. These are fail-safe garden plants for all but the highest elevations of Colorado, much like the wool suit and cotton shirt that will get you anywhere, but it is fun to explore some other horticultural fashions with annuals.

To make an impact from across the street, mid-sized annuals massed together in bright colors are best, for example scarlet annual penstemons (*Penstemon hartwegii* hybrids), a vivid display of mixed zinnias (*Zinnia elegans*), or crystalline white flowering tobacco (*Nicotiana alata*).

Gardeners who have a good skeleton of shrubs and perennials may want to add annuals to fill the gaps in their flowering calendar, replace a winter-killed plant with quick color or disguise fading spring bulbs in May and June. Gaily colored annuals poked into the gaps are the answer. However, sibling rivalry can run riot in the beds and needs to be controlled by good planning at the outset. Tending a garden is much like having a family or being a teacher—you have to protect the sweet, quiet ones from the loud, boisterous ones. Similarly, it is important to prevent the noisier annuals from overshadowing favorite perennials. In my garden, nothing is allowed too close to my beloved perennial *Penstemon* or *Delosperma* species. There are, however, a number of filler annuals that grow vigorously yet can be adequately controlled.

Petunias (*Petunia* x *hybrida*) have a reputation as the K-Mart polyester pantsuit of the horticultural world. But I have found that with careful selection they are invaluable additions in flower beds: they provide instant color, from the moment you get them home in their tiny six-packs (now often only four-packs). It is wise to pinch them back immediately, sacrificing the flowers that made you buy them in the first place. Think of these initial flowers as mere samples to help color-coordinate the garden before the real show begins a few weeks later.

My all-time favorite petunia is 'Azure Pearls,' a glorious periwinkle blue that appears more purple in the afternoon and evening. The flowers are single and not as large as some of the overblown varieties, but they bloom profusely all summer and each fall I bring in a few pots to continue their bloom indoors. Similar petunias are 'Azure Sails' (blue) and 'Yellow Magic,' the latter very pretty in a sunny, hot, all-yellow bed with perennial *Coreopsis verticillata, Zinnia grandiflora*, furry-



Linda L. Wolfe

Gazania rigens

leaved hawkweed (*Hieracium villosum*), Ozark sundrop (*Oenothera missouriensis*), *Penstemon barbatus* 'Schooley's Yellow,' and small, bright annual *Gazania rigens.*

For those who enjoy wearing a few sequins or black tie once in a while, I recommend the flamboyant petunia 'Total Eclipse.' The blossoms are single, brilliant and deep purple with white margins and a good choice for a bed that can deal with their delicious flamboyance.

Another choice filler is globe amaranth, *Gomphrena globosa*. Its flowers look like woolly balls; the bright heads provide color — pink, rose, purple and white — in the late summer months. The plants are compact, usually a foot or so in height, so they do not crowd out other plants. Globe amaranth is slow to get going but by late July this annual will flower and keep flowering until after the first frost. Be sure to pick the flowers soon thereafter for dried winter arrangements. White globe amaranth is a good choice where a sparkling, consistent white color is needed. 'Buddy' is brilliant magenta, similar to the 'Total Eclipse' petunia in effect. My favorite is 'Strawberry Fields,' with amusing red flowers that have white spots like a strawberry.

Snapdragons (*Antirrhinum majus*) are only just a notch above petunias in the flower fashion hierarchy. But with florists charging $1.00 or more for a long stem, it is well worth growing your own, as they are invaluable in summer bouquets. They come in a number of colors but the pale pink, peach and cream varieties are hard to beat for large foyer arrangements and summer weddings. Buy the tall, not dwarf varieties. Show children how to squeeze the corolla to make the "dragon" open its "mouth." The newer butterfly snapdragons are particularly attractive and not quite so old-fashioned. Snapdragons are easy, hardy through at least September and sometimes will reseed or winter over — definitely a good value.

You won't win any points for innovation, but in shady beds you can't grow wrong with a sensible costume of the old standbys wax begonia (*Begonia* x *semperflorens-cultorum*) and impatiens (*Impatiens wallerana*) to fill dull spots. The red-leaved begonias are tolerant of full sun as well. Do not try to grow either of these annuals under a blue spruce or juniper, however; even these stalwart annuals cannot tolerate that treatment.

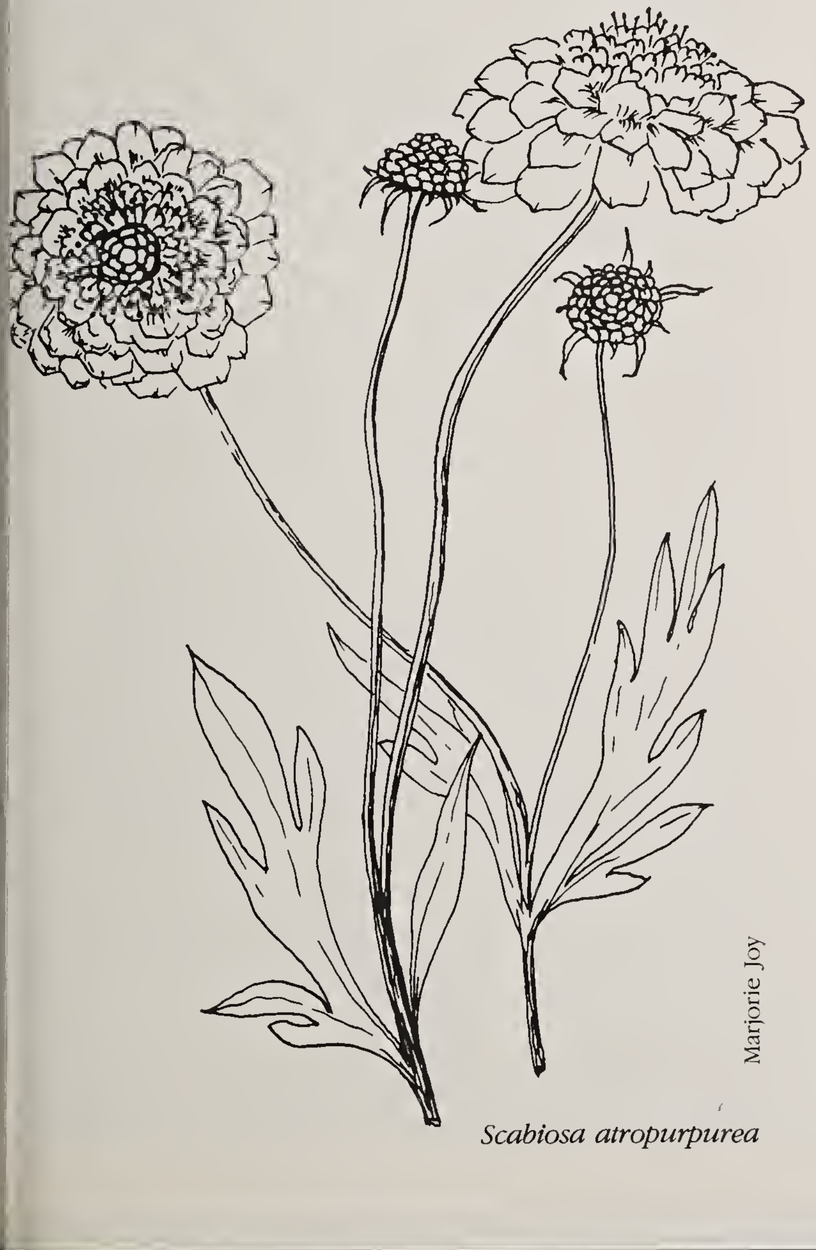
When manufacturers can only afford to make an item or dress of one color, they usually choose blue; tests have shown that most Americans prefer blue to any other color. If you love the blues as I do you might want to consider a whole group of blue annuals to make a beautiful cool corner in the bright part of the garden. This might be next to a sunny patio where the icy colors would create a refreshing ambiance on a hot day. Assuming you have a basic backbone of blue perennials in place — perhaps tall spires of blue delphiniums (*Delphinium elatum* hybrids), Colorado's own columbine (*Aquilegia caerulea*) and blue mist spirea (*Caryopteris* x *clandonensis*) — add all-season blue color with annuals. Kingfisher daisy (*Felicia amelloides*) is a true daisy with a yellow center, only about a foot high, pretty and relatively unusual. It prefers the cooler spring and fall, and appreciates some shade during the height of the summer heat. True sky-blue *Cynoglossum amabile*, also known as Chinese forget-me-not, thrives in light shade, as does blue *Asperula orientalis*, resembling its close cousin, perennial sweet woodruff (*Galium odoratum*) with its lacy, whorled foliage and delicate flower-heads. *Browallia speciosa*, a trailing annual excellent for containers on lightly shaded porches and patios, blooms profusely in soft periwinkle blue, its flowers like a refined, smaller, star-shaped petunia.

In full sun, true-blue, hairy borage (*Borago officinalis*) makes a two-foot statement. On the lavender side of the blue spectrum, *Scabiosa caucasica*, pincushion flower, sends up a generous number of long-stemmed, intricate, misty lavender-blue flowers. Pincushion flower is easy to grow. Do get the bluest ones; the other greyish tones are only good if you want an ethereal look and like to dress in dove grey.

There is nothing like the rich, deep, almost navy blue of*Salvia farinacea* for anchoring a blue bed. To get a good effect, plant at least six close together, preferably twelve, rather than dotting them about with a spike here and a spike there. The dark color emphasizes paler blues and is a dramatic accent in a flower arrangement. Add blue varieties of statice (*Limonium sinuatum*), an annual that stays under two feet and lasts indefinitely in dried-flower arrangments. Don't forget airy, one-foot-tall love-in-a-mist (*Nigella damascena*), as romantic as its name. The seedpods are also excellent subjects for drying, but be sure to leave a few around to sow seed for next year.

There are other situations in the garden where annuals are invaluable. For covering a fence or some redwood lattice, try 'Heavenly Blue' morning glory (*Ipomoea purpurea*) grown from seed for an instant blue bower. Although each flower only lasts a day, they come in such profusion that there is constant color all summer. Equally easy from seed and carefree in the garden are the nasturtiums (*Tropaeolum majus*). They are delicious in salads and come in a variety of heights. The old-fashioned climbing yellow and orange ones might make a cheery accompaniment to the well-named 'Heavenly Blue' morning glories. Nasturtiums need wire, twine or another plant for support if they are to climb. Otherwise, they can be left to trail as a lush, colorful annual groundcover. In part shade, variegated annual hops vine (*Humulus japonicus* 'Variegatus') adds a cool, sophisticated touch to a fence or even the trunk of a tree.

Do you have an ugly metal fence or trash cans to hide? Consider buying a pack of insignificant-looking little spider flower starts (*Cleome hasslerana*) in May, plant them at the back of a bed with plenty of room and watch out. They grow to about four feet and are scratchy and bossy, but in August will delight you with huge pink, rose, purple or white inflorescences, enough to pick and still have a glamorous display. Very pretty against a grey weathered fence (to which it may need to be tied in a windy situation), cleome is spectacular anywhere you have space; it is an annual I would not want to spend the summer without.



Scabiosa atropurpurea

Another easy-to-grow annual of enormous size is the giant sunflower (*Helianthus annuus*). It is a must for two reasons: it is the perfect plant for captivating children and for attracting birds. Help a child plant giant sunflower seeds in an out-of-the-way corner of the garden, show him or her how to water and weed the patch, encourage him to measure the "Jack and the Beanstalk" progress of this fast-growing annual as it grows to eight or ten feet, and you may have created a life-long gardener. Show him how the flowers always turn toward the sun (so try to situate them where they will face into your yard, not the neighbor's). These giants need staking and even that may not prevent the dinner-plate size flowers from drooping under their own weight.

Finally show the child how to collect some of the seeds and save them for the birds. Sunflowers will attract bluejays, finches and, if you are lucky, the brilliant goldfinches that bounce up and down on the leaves like acrobats. If you don't have children, borrow one—this is a good project for you and the birds.

Two more large, easy plants for children to grow and for screens against fences are the airy pink, rose and white daisies of cosmos (*Cosmos bipinnatus*) and the old-fashioned spires of hollyhocks (*Alcea rosea*), the latter making a real fashion comeback after years in the back of the horticultural closet. Hollyhocks are biennial or short-lived perennials, so you need to plan ahead for a display. They sometimes grow to six feet in height and are available in many colors. My favorite is a double pink that rivals the pink peony in charm. The height of these large annuals gives a new dimension to many regional gardens where color tends to stop at waist height. This is because in our rugged climate the smaller, more compact plants tend to survive better and the intense sunlight, wind and dearth of water discourages lanky, luxuriant growth. The best way to add more color at eye level is to plant some really fast-growing, tall annuals.

Another old-fashioned biennial or short-lived perennial coming back into style is sweet william (*Dianthus barbatus*). Its frilly white, pink and maroon flower heads bloom at the time the perennial white ox-eye daisy (*Chrysanthemum leucanthemum*) does, in late spring. Together they make a lovely couple, both in the garden and in the vase.

For easy care and reliable self-sowing, drought-tolerant California poppies (*Eschscholzia californica*) mix well with sweet alyssum (*Lobularia maritima*) in a jumble of orange and white. Colors in the pink, purple and rose hues are also available for both these plants. Let the little Californian native *Phacelia campanularia*, in deep blue, join the carefree melee. These three annuals are so tough that they come up casually in the cracks of the sidewalk.

The most compelling reason to grow annuals every year is to plant patio pots. Because pots dry out fast, it is better to have a few really big ones stuffed full of plants than lots of smaller pots that may need watering twice a day during a heat wave. Remember you are going for maximum effect in minimum space here. Think of patio pots as fashion accessories; now you have a complete outfit. (See separate article on gardening in containers, p. 12.)

Angela Overy has been an instructor of botanical illustration at Denver Botanic Gardens for ten years. She is a master gardener from Douglas County, Colorado; her walled garden was featured in the January/February 1991 issue of *Fine Gardening*.

An Annual Process: Growing Bedding Plants Commercially

by Kelly D. Grummons

The winter solstice has passed and the last straggler of a successful poinsettia crop has found a home. Some plants are opening sleepy eyes to what they think is spring: in actuality, they are being forced out of dormancy for the January opening of the Colorado Garden and Home Show. Plant labels abound in disorganized stacks, newly arrived from the printer. Micky is filling trays with sowing medium, "not too fine, not too coarse," just like his father used to do. New seed lots come in daily, and pots of New Guinea impatiens are already taking root. The ladies over in greenhouse number nine are quietly transplanting the last of the perennial seedlings. A sense of anticipation permeates the nursery. This is the season for annual flowers. The men have sanitized the two-and-a-half acres under glass one more time, providing a clean canvas that soon will be painted with a sea of annual flowers for the 1991 gardening season.

It's quite a process, producing enough flowers to fill countless Colorado gardens, but what a lovely task. Surely we put in more hours than almost any other industry, save perhaps tax accountants, at this time of year. Long winter nights of scheduling hundreds of species now see fruition.

The use of bedding plants started sometime hundreds or even thousands of years ago; no one seems to know for certain. The first American gardens in the late 1600s were graced with lovely wallflowers (*Cheiranthus cheiri*), violets (*Viola spp.*) and other flowers available at the time. Advertisements for "plants to set out" can be found as far back as the 1700s in the United States. Today, hundreds of millions of dollars are spent on annual flowers at the wholesale level alone. Denver's Paulino Gardens started as a truck farm in 1915, supplying produce to the Denver market. In the 1960s, the Paulinos found that customers didn't squabble nearly as much about the price of a geranium as they did about the price of a tomato. Gradually, the entire operation evolved into the ornamental horticulture business it is today—the fourth largest retail garden shop in America.

As seeds arrive at the nursery, they are sorted according to varying sowing dates. Some require a treatment such as refrigeration, but most seeds are ready to go. The medium of Micky's trays is moistened and slightly packed with a "rowmaker" board. The seed is then evenly broadcast down each row with nimble, calculating fingers. Some seeds require a light top-dressing of vermiculite, others do not. Very large seeds such as nasturtium (*Tropaeolum majus*), morning glory (*Ipomoea purpurea*), sweet pea (*Lathyrus odoratus*) and four-o'clock (*Mirabilis jalapa*) are sown in their final containers.

Most of the trays are placed on sand beds that radiate heat from buried cables, then covered with sheets of plastic and shade cloth. The seeds

Shirley Nelson

Lathyrus odoratus

need to be warm, but not cooked, to germinate. Grandpa "Gramps" Paulino showed his son Micky, and Micky taught me how to make sure the conditions are just right. Twice a day we peek under the cloth. As soon as a few little heads poke up, we pull those trays out to a brightly-lit table at room temperature.

The annual seedlings develop quickly. Within a week or two, true leaves appear above the first seed-leaves, called cotyledons, and the ladies, with loving skill, pluck the young plants from the flat and plant them gently in appropriately sized cell-packs or pots. This excruciatingly tedious work lasts for months, ten hours a day until the season is over, about the middle of May.

Gardeners along the Front Range are becoming quite sophisticated horticulturally, expecting new flower varieties every year. All America Selections award winners are added to our annual line-up, along with requested and promising new varieties. If we grew only the things we liked, we would be out of business. The current trend in annual flowers is toward petite, less bold forms and textures and softer colors. Nonetheless, red geraniums (*Pelargonium* x *hortorum*), petunias (*Petunia* x *hybrida*) and marigolds (*Tagetes spp.* and hybrids) are still very popular. These annuals, the backbone of our business, are starting to give way to pot dahlias, impatiens (*Impatiens wallerana*) and dozens of other annuals that are more durable, drought-tolerant or just plain different.

There is a saying posted in our store that begins, "If our customers only knew how many bushels of soil it took. . ." and ends "then they would find the price of our plants very reasonable." Annuals are a labor-intensive product with a great deal of overhead expenses: heating and cooling costs are well over one dollar per square foot per year. The biggest challenge is finding qualified people willing to do the work required to produce a marketable crop.

At Paulino's, we grow the varieties we are good at producing. Other growers supply us with certain crops that require conditions or expertise we don't have. For example, some varieties require growth-regulating chemicals to make them marketable in pots. Others, such as fuchsia, need months of pruning and shaping to create the perfect plant. As for cost, some seed is very reasonable, while some, such as hand-hybridized varieties, cost ten cents or more per seed, resulting in a six-pack production cost of sixty cents or more just in seeds alone.

As traditional as our business is, new technologies are moving into the picture. Computerized environmental control helps maintain an optimum atmosphere in the greenhouse but I still need to have a daily and personal relationship with all of the plants. Styrofoam and long-lived plastic containers are now beginning to be replaced by more environmentally sound materials. Soil and part-soil media have given way to the convenience of packaged soil-less media. Now that the once-economical peat moss is becoming scarce, other inert materials such as rock wool are being substituted. Less expensive locally-available aspen humus is replacing exotic peats.

Interestingly, the nursery business is somewhat recession-proof. During financially hard times, people tend to postpone vacations and spend a little more on the home and garden. Flowers and gardening do more for the state of mind than most people realize. Who wouldn't find his or her spirits lifted by walking into a garden billowing with spikes of larkspur (*Consolida ambigua*), fragrant stock (*Matthiola incana*) and satiny godetia (*Clarkia amoena*). If everyone would plant a flower garden this year, the world would be a lovelier place and our problems would diminish.

Above my kitchen sink hangs a plaque with a verse especially appropriate today:

When all the world wearies,
And society ceases to satisfy,
There is always the Garden.

— Minnie Aumonier

Kelly Grummons, horticulturist at Paulino Gardens in Denver, came from northeastern Wyoming with a passion for plants from the Great Plains. He earned joint degrees in horticulture and landscape management from Colorado State University. He enjoys exploring the prairie in search of new garden prospects with other hard-core gardeners.

Annuals in the Perennial Border

by Keith Funk

Most gardeners who grow perennials eventually tire of the same plants in the same place year after year, and start to play the inevitable game of musical chairs with them. Older and more common varieties lose their place to newer and more unusual species. The plants that remain must contend with the shock of being moved, divided or simply disturbed by the relocation of neighbors. The end result of all this juggling is hodge-podge of newly planted, recovering and established plants, in no way resembling a finished border, which takes several years to mature.

Creativity in the garden doesn't always mean growing the newest varieties or the most exotic species. More often than not, the creative gardener simply combines familiar plants in new and different ways — like adding annuals to the perennial border, for instance.

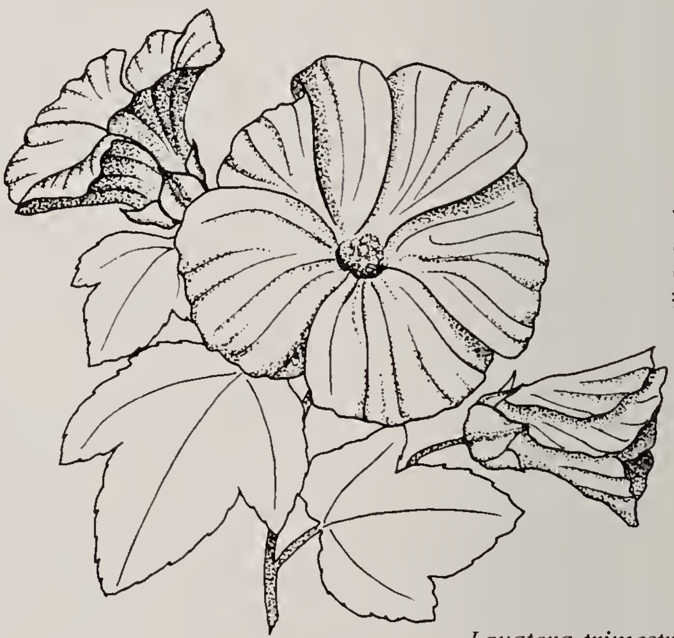
To save my mature, well-established perennials from trauma, I incorporate annuals to satisfy my need for change. Because annuals are quick to grow and bloom from seed, are fairly inexpensive and bloom nearly all season, they are invaluable for tying together the various blooming seasons of perennials. Best of all, I can experiment with colors and textures each year to create new combinations.

Tall back-of-the-border annuals are not easy to come by. *Nicotiana sylvestris*, a bold yet elegant plant, produces a broad rosette of oval leaves, from which rises a 4-5 foot flower stalk. Clusters of pendant white flowers open from midsummer to frost. Planted in groups of three to five, *Nicotiana sylvestris* contrasts nicely with a dark wooden fence as a backdrop. It blooms equally well in full sun and part shade, and has a sweet fragrance in the evening. The lush foliage helps cover gaps left by early-blooming plants that die down after flowering, such as oriental poppies (*Papaver orientalis*), bleeding heart (*Dicentra spectabilis*) and spring bulbs.

Mexican sunflower (*Tithonia rotundifolia*) is one of the largest plants grown as an annual. Huge, coarse leaves nearly a foot long clothe the sturdy 5-6′ stems. In mid-July the plant begins producing brilliant fiery red-orange flowers with yellow centers that resemble large zinnias. The color is intense — a little goes a long way. Mexican sunflower's size and coarse texture fill gaps in the background of a sunny border.

Cosmos (*Cosmos bipinnatus*) is another tall, back-of-the-border annual, but has a delicate effect due to its ferny foliage and airy stems. Daisies in shades of lavender, magenta, pink and white are borne in great numbers from midsummer until frost. They make fine cut flowers. The finely-textured foliage softens bolder plants such as roses, peonies (*Paeonia lactiflora*), phlox (*Phlox paniculata*) and the more dramatic annuals Mexican sunflower and *Nicotiana sylvestris*. A smaller, pure white variety, 'Sonata,' is ideal for gardens short on space.

Two seldom-planted but pretty members of the mallow family are *Lavatera trimestris* and *Malva sylvestris*. Both make dense, bushy plants, and generously produce rose-pink flowers very similar to a hollyhock's (*Alcea rosea*), minus the problems with staking or rust. Both are easy to grow and give continuous color from July until frost. I like them best planted with daylilies (*Hemerocallis* hybrids) and shasta daisies (*Chrysanthemum* x *superbum*).


Jill S. Buck

Lavatera trimestris

Throughout the middle of the border, the fun starts in earnest. This is where the garden gypsies — annuals that self-sow — grow and bloom, creating endless combinations with the more static perennials. Letting chance design the border isn't for everyone; order and predictability are flung by the wayside.

A true border vagabond is Shirley poppy (*Papaver rhoeas*). Its blue-green foliage is a perfect foil for the large, diaphanous blossoms that come in a wide range of soft, clear colors. Shirley poppy only blooms for a few weeks in early summer, but then politely dies to the ground and disappears, making room for later-developing plants. This lovely annual's ability to reseed in just the right spots among my iris (*Iris germanica*), blue flax (*Linum perenne*) and penstemon (*Penstemon spp.*) guarantees my abiding love for it.

Larkspur (*Consolida ambigua*) is a sentimental favorite of mine, evoking fond memories of my grandmother's garden. It is often called the annual delphinium because it has much of the same beauty and vertical elegance. However it is shorter and has ferny foliage, lending it a more casual look. Larkspur is also much easier to grow than delphinium and blooms for a longer time in shades of white, blue, pink and purple. A spot lightly shaded from the hottest sun will keep the plant in flower for the longest time. Larkspur combines beautifully with old-fashioned perennials such as oriental poppies, lilies (*Lilium spp.* and hybrids), Siberian iris (*Iris sibirica*) and golden coreopsis (*Coreopsis grandiflora*). After a few years of self-seeding, the blues and purples predominate. This can be prevented by cutting large, long-lasting purple and blue bouquets for the house and leaving the lighter-colored plants in the garden to set seed for the next year.

The perfect plant to hide unattractive bearded iris leaves during the summer is native *Euphorbia marginata*, sometimes called snow-on-the-mountain but not to be confused with the perennial groundcover of the same name (*Aegopodium podagraria* 'Variegata'), variegated cousin to the evil goutweed. *Euphorbia marginata* grows into a bushy, 2-foot plant. Its succulent, grey-green leaves have white margins and the tiny flowers are accompanied by large, leafy, pure white bracts. This annual relative of the poinsettia is happy in any soil, in full sun and through the heat of the summer. The young plants wait their turn while the irises bloom, then grow quickly to cover the unsightly iris foliage, imparting a pale green and white coolness on hot summer days. Thin out all but a few seedlings each year or else crowding will shade the iris too much.

The gloriosa daisy (*Rudbeckia hirta* var. *pulcherrima*) has all the rugged durability one would expect from a prairie native. There are many varieties, but I prefer the 'Pinwheel' selection with large, single flowers in yellows, golds, oranges and mahoganies, all with chocolate-brown centers. They grow and self-sow in most any soil and bloom beautifully in the most intense summer sun. The flowers have an assertive quality that needs the company of soft textures and colors — blue salvia (*Salvia farinacea*), cosmos, blue flax and ornamental grasses all make lovely companions.

Near the front of the border, plants must tolerate some abuse. Mowers, children and pets all take their toll on slow-growing, brittle and generally wimpy plants. Fortunately there are several annuals that meet the challenge.

Madagascar periwinkle (*Catharanthus roseus*) is a gem for gardens where intense summer sun, drought and heat limit the choice of plants. Its glossy, dark-green leaves and delicate pink, white or purple flowers remain crisp and healthy in conditions that would wilt nearly any other plant. It makes a great city plant, being pollution-tolerant as well. Few other annuals are as versatile, offering lush, clean, insect-free foliage, a multitude of flowers and a low, neat form. Finally Madagascar periwinkle is getting well-deserved attention from gardeners and hybridizers alike.

Though there are many less-common plants to choose from, I often rely on sweet alyssum (*Lobularia maritima*). Fragrant white, pink or purple flowers cover this plant from late spring until a hard frost. Children, pets and even devastating hail don't stop this plant from carpeting the ground with color. It will reseed year after year. Alyssum is usually planted as an edging in the front of the border, but thanks to its ability to self-sow and its small, delicate demeanor, alyssum is also excellent naturalized in a rock garden, between paving stones or as an informal groundcover under taller, open and leggy plants such as hollyhocks, roses or four o'clocks (*Mirabilis jalapa*).

Brilliant flecks of gold over a low, dense carpet of ferny, emerald-green foliage describe Dahlberg daisy (*Dyssodia tenuiloba*). The busy gardener couldn't ask for an easier plant. A perfect edging annual, it is particularly charming in the rock garden, in crevices of rock walls or among paving stones. Good companions to grow behind it include flowering tobacco (*Nicotiana alata*), dusty miller (*Senecio cineraria*) or red salvia (*Salvia splendens*).

One other little-known and hard-to-find annual worth some searching for is cup flower (*Nierembergia hippomanica*). Neat low, spreading mounds of foliage are smothered with blue-violet bell-shaped flowers all summer long. Substitute this plant for lobelia (*Lobelia erinus*) in hot places where the latter dies out. Combine it with blue sheep's fescue (*Festuca ovina var. glauca*), marigolds (*Tagetes spp.*), sweet alyssum, calendula (*Calendula officinalis*), snapdragons (*Antirrhinum majus*) or Dahlberg daisy.

Keith Funk, a Colorado resident for twelve years, received a B.S. in landscape design and an M.S. in ornamental horticulture from Kansas State University. He has been Retail Manager of Echter's Garden Center in Arvada, Colorado for nine years, and is an avid gardener.

Annuals for the Connoisseur

by Lauren Springer

Until two years ago, when I finally bought a house, my gardens were always dominated by annuals. I'm a postmaster's nightmare: my personal record of tenure at one address is 30 months. These gypsy habits led to an unnaturally large, well-worn collection of trunks and cartons in the basement and a finely-honed appreciation of unusual annuals.

The public and private gardens I toiled in to earn a living only strengthened my devotion to perennials and native plants. Petunias and marigolds offered at nearby garden centers seemed barely a step away from plastic; any plant whose tag described it as "an even mound smothered in large, brilliant flowers," I abhorred. I was determined to create my own garden in the image of the subtle, graceful perennial borders, rock gardens, and woodland and meadow plantings I tended for a living, but I needed to accomplish this with annuals.

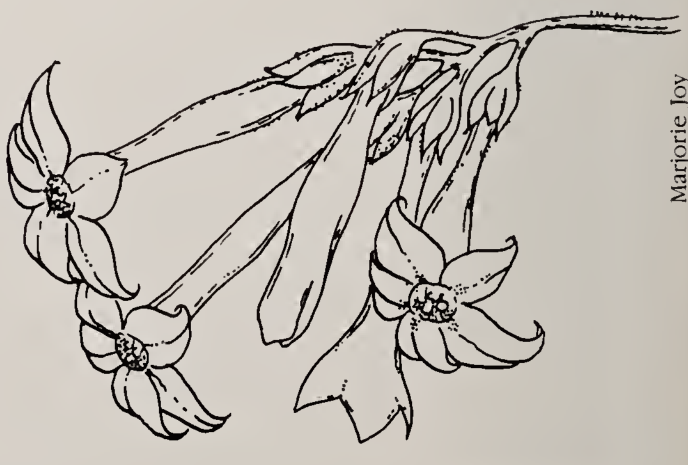
The answer came in the form of several good seed catalogs. Clothes in the closet gave way to a mini-greenhouse of seedlings under fluorescent shop-lights bought on sale at Sears. Discarded pots were salvaged from local nurseries' dumpsters, milk cartons were cut into containers. Several cottage gardens of annuals ensued, some beautiful, some less so.

A decade of this kind of experimentation rewarded me in my new house's first-season garden. After three months of sod-stripping, digging, manure-hauling and planting trees, shrubs and perennials, I ran out of steam and money. The young plants looked forlorn and large areas were left unplanted. Annuals came to the rescue, and never were they more lovely than in and among the fledging perennials and shrubs.

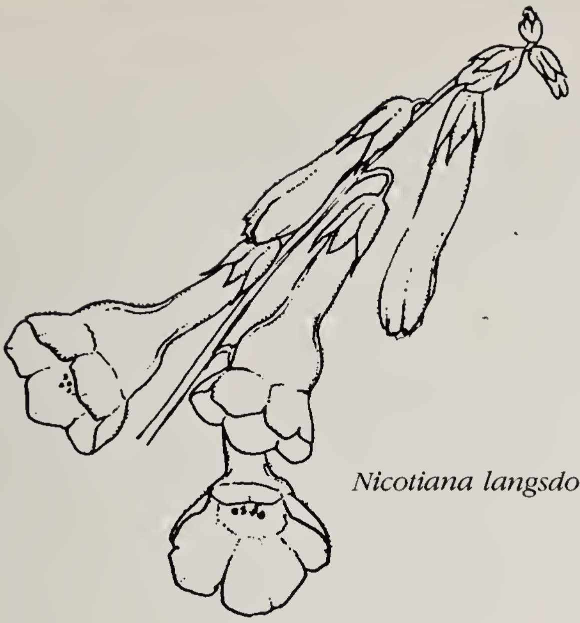
There are several distinct areas in my garden, both in terms of light exposure and in terms of color and overall mood. The east side of the garden gets afternoon shade, making it a perfect area for traditional garden plants that need extra water and some protection from the hot, drying Colorado sun. Here I allow myself to express nostalgia for the Irish and English gardens I have worked in.

A dozen large, hardy old garden roses—gallicas, mosses, damasks and albas—bloomed only sparsely the first year, in shades of blush pink, lavender and white. It will be three years before they reach their full size and flowering strength. An underplanting of perennials, dominated by chartreuse-flowered lady's mantle (*Alchemilla vulgaris*), late-blooming pink and white Japanese anemone (*Anemone* x *hybrida*), blue monkshood (*Aconitum napellus*), blue and lavender milky bellflower (*Campanula lactiflora*) and pale yellow columbines (*Aquilegia chrysantha*)—compliments the soft feeling and gentle color scheme of the roses, but was modest at best the first season, as perennials are apt to be. A wonderful birthday present of 50 unusual lily bulbs from a close friend (only a good friend would know that a box smelling of sphagnum moss rather than perfume is what excites a real gardener) should make a splash in the coming years. What made this garden a success the first year, a mere two months after planting, were some truly wonderful annuals.

In this lightly-shaded, old-fashioned garden, I planted pale pink, white and lime flowering tobacco (*Nicotiana alata*) in large sweeps. Toward the back, near the grey and white clapboards of the house, tall white *Nicotiana sylvestris* and the drooping chartreuse bells of *Nicotiana langsdorffii* mingled with the largest of the roses. I dotted half a dozen large clumps of the two-foot tall, white, double-flowered feverfew (*Chrysanthemum parthenium* 'White Wonder') throughout, which I cannibalized for cut flowers from June until frost without noticeably harming the garden display.



Nicotiana sylvestris



Nicotiana langsdorffii

To blend with the chartreuse nicotianas and the pale yellow columbines, which were the most floriferous of the perennials the first season, I grew 'Cut Wonder,' a tall, 18", lavender-blue form of popular flossflower, *Ageratum houstonianum*. It had a perennial's grace of habit, yet bloomed nonstop from late June into September. It also proved to be a great cut flower, and attracted butterflies in the morning when the sun lit that part of the garden.

The front of the garden borders on a sidewalk. To soften the edge, airy lavender Swan River daisies (*Brachycome iberidifolia*) flopped and trailed onto the pavement. Velvety purple and blue johnny-jump-ups (*Viola tricolor* 'Helen Mount,' 'King Henry,' *V. cornuta* 'Cuty') bloomed from April into November with the help of afternoon shade. Sweet alyssum (*Lobularia maritima*) wove in and among the front plantings, filling the air with its honey scent.

At dusk, the palest flowers glowed the brightest, transforming the garden. Mauve, pink and white evening stock (*Matthiola longipetala ssp. bicornis*) wafted its sweet perfume over passing teenagers celebrating their graduation late into the night. I would leave the livingroom windows open all night to let the scent into the house. Two fierce shearings rejuvenated this plant and brought on more flowers until hail put an end to it the last weekend in July. Who knows how long it would have lasted without the intervention of golfballs from the sky.

Next year the roses and perennials should contribute their share of color and scent, but I was so enamored of the annuals, I will be sure to include them again. Tall biennials I planted last year will add to the old-fashioned, cottagy feel: foxgloves (*Digitalis purpurea* 'Apricot Beauty'), pale yellow evening primrose (*Oenothera biennis*), pastel hollyhocks (*Alcea rosea*), and fragrant lavender and white sweet rocket (*Hesperis matronalis*).

On the other side of the house, a totally different garden is taking shape. Dwarf conifers, shrubs, evergreen groundcovers, herbs and native plants will give this area year-round interest as they mature. The colors are more vibrant, the textures and forms tighter and more precise, and the plants heat-, sun- and drought-tolerant. Again, the perennials were small and puny the first year, save for some overly-eager iceplant (*Delosperma nubigenum*), thyme (*Thymus spp.*) and pussytoes (*Antennaria spp.*).

Several annuals lifted my spirits during the long, hot summer days. I had sprinkled seed of native prickly poppy, *Argemone platyceras*, the fall before, having admired it along the roadsides. It came up well and gave a long succession of what a neighbor's child called "fried-egg flowers," four-inch white cups with bold yellow centers. The same child tried to pick one and was painfully chastised by the thorny plant.

Sky blue *Nolana paradoxa* sprawled nearby. It lost its flowering pizzazz by the beginning of August, but had combined so well with orange and yellow California poppies (*Eschscholzia californica*) earlier in the summer that I'm determined to grow them together again. Low-growing golden Dahlberg daisy (*Dyssodia tenuiloba*) mingled with deep blue *Phacelia campanularia* and white and yellow moss roses (*Portulaca grandiflora*) along my sandstone path. I'm hoping a few will seed themselves in the cracks next year.

Deep in the beds of this area, I let burgundy, white and pink sleepy poppies (*Papaver somniferum*), purple *Verbena bonariensis*, white *Lavatera trimestris* 'Mont Blanc,' purple-leaved beefsteak plant (*Perilla frutescens*) and bronze-leaved fennel (*Foeniculum vulgare* 'Purpureum') fill the many empty spaces between the undersized shrubs and perennials. The large, pale yellow flowers of *Hibiscus trionum*, with chocolate eyes, were fennel's ideal partner. The fennel left a delicate anise scent on my clothes and in the air whenever I brushed against it. I expect seedlings of all these annuals to emerge in full force next year, thanks to their parents' copious production of seed, but I collected a bit just in case. Two sun-loving, drought-tolerant biennial giants formed massive 2-3' wide foliage rosettes: the woolly silver mulleins *Verbascum olympicum* and *V. bombyciferum*, and platinum scotch thistle, *Onopordum acanthium*. Next year they will match me in height as they bloom, set seed and then die, and hopefully will resow themselves to start the cycle anew.

I had left a large, 15 x 10' area totally devoid of plants, due in part to a shrunken wallet and in part to a load of hot manure that burned the few perennials I had planted there. In June, when everything elsewhere was growing vigorously and the garden's brown areas were rapidly receding, this patch of bare earth rankled me to no end. I found a few old packets of deep purple *Verbena rigida*, white *Cleome hasslerana* 'Helen Campbell' and orange-red *Cosmos sulphureus* 'Sunny Red.' My instincts warned that this would be an awful combination, but I sowed the seeds anyhow, in great sweeps, desperate to cover the ground. It turned out to be a wonderfully attractive surprise. Aside from their vibrant colors, the plants brought wildlife into the garden. Cleome buzzed with bees and the verbena attracted a bevy of butterflies, among them swallowtails, checkerspots, red admirals, painted ladies, viceroys and monarchs. Late in the fall, birds, especially finches, fed on the seed of the cosmos.

I was blessed with another unplanned success in the area near my old, run-down shed and the trash bins. I had fought the insidious puncture vine (*Tribulus terrestris*) there the summer and fall before, and wanted to plant something just to gloat over my victory, a beautiful annual or two to proclaim I had won over this patch of soil, much like a flag raised on newly-captured territory. Again, my creative juices were running dry and my choice of seedlings was limited by the time I got around to planting the area. On one end, I sowed leftover seeds of pink Rocky Mountain bee plant (*Cleome serrulata*)—another native I'd coveted and collected from the roadside—huge white *Cosmos bipinnatus* 'Purity,' and deep blue and purple larkspur (*Consolida ambigua*). The other end received a perfunctory planting of a few flats of pathetically overgrown, lanky seedlings of blue bachelor's button (*Centaurea cyanus*), calliopsis (*Coreopsis tinctoria*), Queen Anne's lace (*Ammi majus*), tassel flower (*Emilia javanica*), blue sage (*Salvia farinacea*) and Texas scarlet sage (*Salvia coccinea*), all originally slated for the cutting garden but left out for lack of room. Both areas, hot and dry, were given more attention by passersby and guests than by this gardener. They were the hits of the summer garden, colorful yet unkempt enough to evoke a natural scene. I think the fact that half of the plants were native American wildflowers contributed to this effect.

The one place where unnatural, exotic beauties are allowed to revel is on my porch, in containers. The close association with the house keeps the plants from jarring as they would if interplanted among the rest of the garden plants. For some reason, contrary to fashion, I have never liked combining many plants of different colors and textures in pots. I like the pots simple as well—plain terracotta, preferably hand-thrown and in the more beige or pink clays. I also have grown to love the cedar boxes my husband slapped together for me from left-over fence pickets. The cedar has slowly weathered to a soft, silvery tan.

On the shaded part of the porch, I let white flowers dominate, to go with the peeling white wicker furniture we sink into on hot days. White-flowered, fragrant angel's trumpet (*Datura suaveolens*) begins blooming in late summer. It never reached the proportions I was accustomed to from conservatories, but at four feet, it made me very happy. Smaller pots filled with *Caladium* 'Candidum' and 'White Christmas,' two white-and-green veined varieties of this foliage plant, carried on the white theme, as did a box planting of white impatiens (*Impatiens wallerana* 'Super Elfin White') and the pretty foliage of polkadot plant (*Hypoestes phyllostachya* 'White Splash'). Houseplants, not my forte, have been reduced to a few hanging plants that the cats can't reach. The asparagus fern (*Asparagus densiflorus* 'Sprengeri') and several spider plants (*Chlorophytum comosum* 'Variegatum') were put out to pasture on the porch for the summer, and mingled nicely with the white-flowered annuals, adding a lush, tropical feeling.

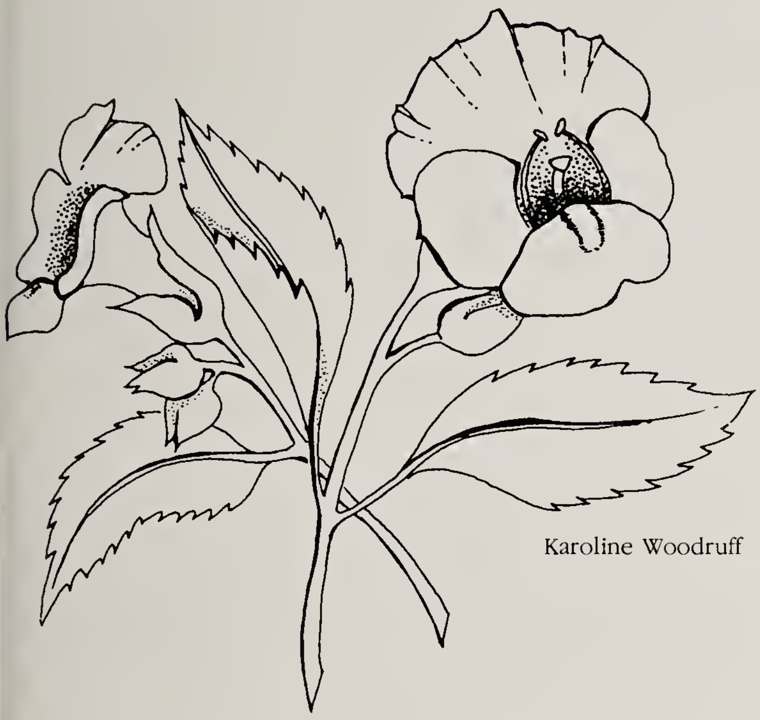
On the sunny part of the porch, I hid a small pot of dowdy mignonette (*Reseda odorata*) among the showier plants, just for its wonderful scent. Shrimp-pink, airy twinspur (*Diascia barbarae*) spilled from two hanging baskets, as did lavender *Verbena* x *hybrida* 'French Blue,' which I mixed with feathery little Mexican fleabane, *Erigeron karvinskianus*. In several pots I jammed a conglomeration of various scented geraniums (*Pelargonium spp.*) and let their leaves subtly contrast. My favorite pot lasted only two months, and then was thrown to its death off the porch wall by a violent cat fight. I will repeat it this year, if I can find the plants. I had grown unusual *Anisodontea capensis* (also known as *Malvastrum capensis*) from seed. It formed a 2-foot shrublet with many small, shrimp-pink, round flowers. At its base, I stuffed the velvety silver and chartreuse sprays of *Helichrysum petiolatum* and its variety 'Limelight,' which I had to buy as plantlets through the mail, and some 'Purple Ruffles' basil (*Ocimum basilicum*). Containers beg for experimentation; it is the rare case when I repeat a planting, but this one, extinguished in its prime, must be tried again.

As the garden matures, I'm sure the annual players will become less important. But to be entirely without them would be to lose out on some of the loveliest, most rewarding plants that make their home in a garden. Many a plant snob has said to me, "oh, but that's just an annual." To which I reply, "and a mighty fine plant it is."

Lauren Springer received her master's degree in horticulture from Penn State. She teaches, photographs and writes a weekly gardening column for *The Denver Post*. In her northern Colorado garden, she grows over 800 species of plants from seed, including nearly 100 annuals.

Torenia fournieri

by Rob Proctor


Karoline Woodruff

The unusual arrangement of twin stamens inside the throat of *Torenia fournieri* inspired the common name wishbone flower. Its yellow throat is surrounded by blue petals with violet tips. The individual trumpet-shaped blossoms are small, less than an inch across, but are produced abundantly throughout the summer.

Wishbone flower is a boon to shade gardeners, for it extends the color range available in bedding plants. Hybridists have recently developed color breaks that have produced flowers in pink, lavender, and mauve tones. The original blue flowers are the most charming, however, topping bushy plants that grow up to a foot tall. The lobe-shaped leaves are an attractive bronzy green.

T. fournieri may be easily raised from seed sown in March at 70° F. Germination takes 10 to 15 days, and the seedlings need about two months in the greenhouse before they are ready for life outdoors. Due to its Vietnamese origin, wishbone flower requires heat and moisture to thrive. Plants that are set out too early will stunt if night temperatures drop below 50° F.; planting should usually be delayed until late May or early June.

Because the plants are compact and grow evenly, they are useful for edging and formal designs in semi-shady areas. Clumps of wishbone flowers planted among hostas and ferns are charming. They enliven porch and patio containers, although care should be taken that they do not dry out. Imagine the violet flowers planted with yellow tuberous begonias (*Begonia* x *tuberhybrida*), their yellow throats echoing the larger begonia flowers. Asparagus fern (*Asparagus densiflorus* 'Sprengeri'), dusty miller (*Senecio cineraria*), and pink or white impatiens (*Impatiens wallerana*), make handsome companions as well.

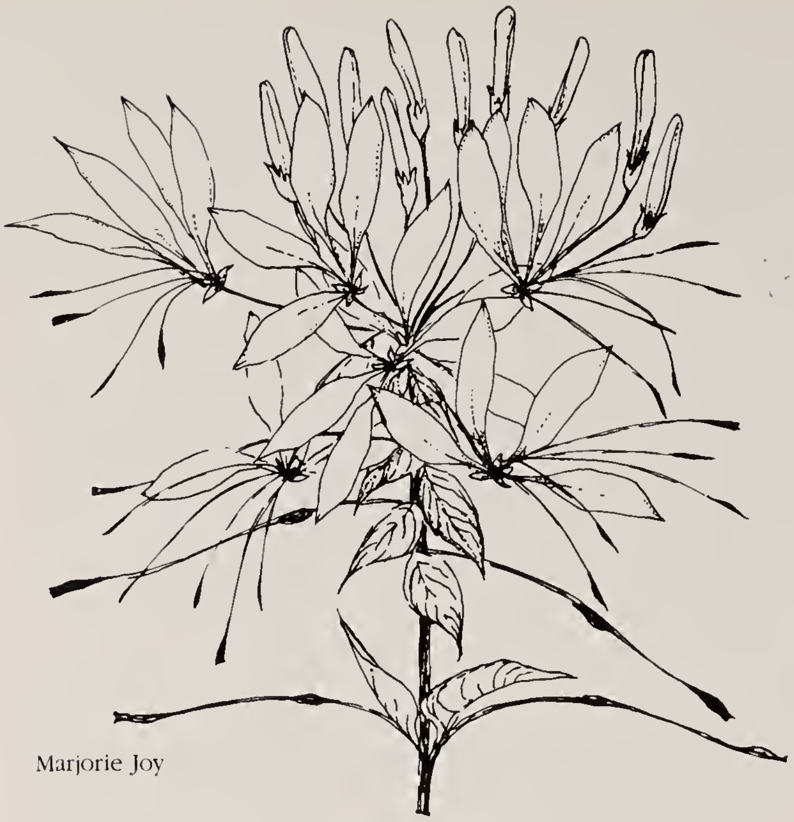
Rob Proctor is the author of *Antique Flowers: Perennials* (1990) and *Antique Flowers: Annuals* (1991). He is gardening columnist for *The Denver Post* and teaches botanic illustration at DBG.

Cleome hasslerana

by Alcinda Cundiff

I never thought annuals would have a place in my foothills garden until I realized they could help in the struggle against my major garden pest: deer. My first attempts to garden in the unfenced and untamed area behind my house were a disaster. The deer wiped out the vegetable garden next to the porch in late summer with one lightning raid. The following spring, they consumed large portions of a new border right against the house. I then realized that their destruction was confined to times of the year, spring and late fall, when their preferred foods—the apples, sumac and other plants in our mini-wilderness—were absent or dormant. This suggested that I could plant annuals around the house after the deer had retreated to the natural areas. Ideally, the plants would become established, bloom and be on the wane before the deer returned.

Many annuals are too flamboyant and too labor-intensive for my gardening style. But I had recently put a small, grassy play yard next to the porch and wanted some colorful, even fantastic, plants for the children's area. One bed bordered a garage and faced the natural area across a small terrace. Flowers there needed to harmonize with the garage, be compatible with the nearby wild



Marjorie Joy

plants and require little care in the exposed, east-facing location. I had seen a dramatic plant in municipal plantings nearby that seemed to meet all my requirements: *Cleome hasslerana*, spider flower, a member of the caper or Capparaceae family. I decided to put it in back of the border.

Cleome hasslerana reaches four to six feet, sometimes requiring staking. Its width is influenced by how close together it is planted. I densely planted the seedlings I found at a local garden center and let competition select the largest. They filled in well and bloomed from mid-summer through September. The flowers are large, open in appearance and have very long stamens, hence the common name, spider flower. I used pink varieties; shades of crimson and purple and an all-white variety, 'Helen Campbell,' are also available. They should not require much water but my plants did wilt on the hottest days, a condition that should improve once the soil in this new area is amended with some moisture-retentive organic matter. The entire border escaped the deer, encouraging me to experiment with more annuals next year. I think this was due to the timing of the planting—the annuals went into the ground after the spring deer foray, and were pretty much over by mid-fall when the hungry animals returned. The strong foliage scent and somewhat spiny nature of the spider flowers may have deterred them as well.

Cleome hasslerana is a model of the plant many gardeners are seeking: it has modest cultural requirements and fits well into landscapes that are neither purely native nor imported. This is probably because it has native relatives—we are accustomed to seeing *Cleome serrulata*, Rocky Mountain bee plant, blooming in the foothills and on the plains in July and August. I for one eagerly await more annuals with these characteristics.

Alcinda Cundiff is a researcher in biology at the University of Colorado in Boulder. A former editor of *The Green Thumb*, she has written articles on butterflies and grasshoppers for *Fine Gardening* magazine.

Ipomopsis rubra

by Sandy Snyder

Ipomopsis rubra is worth any attention you might give to get it started in the garden. This tall trumpet-flowered biennial seems to lead two lives. The first year it catches the eye with an unusual, ground-hugging foliage rosette a bit larger than a half-dollar. The leaves look like many one-inch needles criss-crossing each other. The second year this plant becomes a four- to six-foot tall spike with bright red one-and-one-half-inch long trumpet flowers running up and down it. It is perfect in the background or scattered among other plants in a perennial border.

The angel trumpet or standing cypress, both common names for *Ipomopsis rubra*, is an excellent late-summer bloomer. Sometimes the flowers begin halfway down from the top of a single stalk, but more often the top third of the plant forms additional spikes, each one loaded with red flowers. This makes the plant look top heavy, yet it rarely breaks or falls over. It just sways in the wind, attracting both hummingbirds and people from quite a distance.

Ipomopsis rubra grows in my garden with very little help. All I have to do is scatter its white seeds around my garden. The seeds are ready for sowing when they begin to fall out of their pods in late October. Sowing the seeds is fun. I have spread this plant around my neighborhood because I like to pick the stalk and use it like a magic wand, shaking the seeds into gardens, fields and rock piles. No matter where I scatter them, they seem to grow. With a lot of water they reach six feet; with limited moisture, they stay around three feet or so. If they are not growing where you want them, move the feathery foliage rosettes in the spring of their first year.

Ipomopsis rubra is difficult to find in nurseries, probably because the plants look awful in pots and people won't buy them unless they know that they need only one desperate-looking plant to start a whole colony of angel trumpets in their gardens.

Ipomopsis rubra is sometimes still called *Gilia rubra. Phlox, Gilia* and *Ipomopsis* are all in the same family—Polemoniaceae or the phlox family. It is found growing wild from South Carolina to Florida and Texas.

Ipomopsis rubra does very well in many types of gardens along the Front Range. At this time, these gardeners are the best sources for seed. The plant is so tall, bright and showy that it is easy to spot from the car once you know what to look for. Gardeners, as so often is the case, have kept this plant going in spite of its being virtually ignored by magazines, books and commercial sources. They know how easy *Ipomopsis rubra* is to grow, how colorful and dramatic it looks, and how satisfying it is to give away to others. This summer I urge you to search the nursery and garden territory to stake out plants and seed sources of *Ipomopsis rubra*. Once it is established in your garden, you will enjoy this well-behaved and beautiful plant without giving it another thought.

Sandy Snyder is a gardener in the Rock Alpine Garden at Denver Botanic Gardens. She also has her own landscaping and consulting business, and writes and teaches on the side. Her garden in Littleton, Colorado, has been the subject of several articles, both locally and nationally.

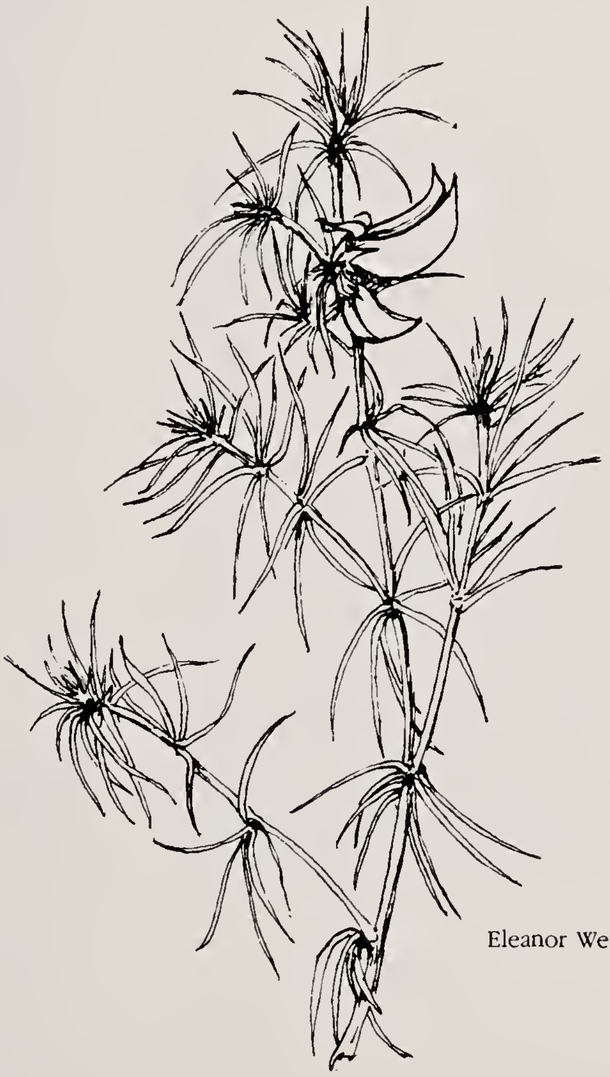
Lotus berthelotii

by Eleanor Welshon

I first met the lotus vine, or parrot's beak, as a houseplant. The fine silver foliage tumbled from a hanging basket. It had the effect of an asparagus fern (*Asparagus densiflorus* 'Sprengeri') but the leaves and stems were a beautiful grey-green color, silky soft rather than prickly. I loved it on sight and promptly took it home.

About a year later, I saw it used in container gardens. The fine, whorled, pinnate foliage was a marvelous foil for petunias (*Petunia* x*hybrida*) in pinks and lavender-blues, and blue ageratum (*Ageratum houstonianum*) centered with taller white marguerites (*Argyranthemum frutescens*). Another pretty planting was a combination of pale yellow petunias, yellow marguerites and lemon marigolds (*Tagetes patula*). I've used it to edge my porch boxes of hot pink or red geraniums (*Pelargonium* x *hortorum*) and deeper-colored petunias. Silver foliage has a way of enhancing most garden flowers and *Lotus berthelotii* is no exception.

Lotus vine grows to about six or eight inches tall before the stems relax and start to drape over the edge of the pot. The flowers are a light red and bloom in early summer, resembling a parrot's beak.


Eleanor Welshon

In the Canary Islands and Cape Verde where this plant originates, and in the frost-free areas of this country, lotus vine is used as a low-growing perennial shrub or groundcover, spilling over rocks and walls very gracefully. I've found it to be a little hardier than the petunias and geraniums it was planted with. When the first hard frost killed off those annuals, only the tips of the branches of the lotus vine were hit. I cut one back and brought it into the house where it continues to fill out quite nicely on a sunny windowsill.

My first hanging basket ended in disaster. I failed to notice it needed water and every single leaflet shriveled, dried and fell off. It's a good idea to check the plant daily since you won't be forgiven if you forget. Outside, *Lotus berthelotii* thrives in containers with the same care as its companions. Pinching back encourages branching and keeps it fat and sassy. Propagation is by cuttings or from seed.

Lotus vine is still quite uncommon as an ornamental plant in gardens. It is a member of the Leguminosae, or pea family. Winged pea and coral gem are two other common names. It bears no resemblance to what is usually thought of as lotus, that exotic water plant associated with Cleopatra and the Nile. The closest relative of *Lotus berthelotii* in cultivation seems to be the yellow-flowered forage crop bird's foot trefoil, *Lotus corniculatus*. How such dissimilar plants came to share the same name remains a mystery best left to the taxonomists. Lotus vine is available at some Denver garden centers as starter plants and as hanging baskets.

Eleanor Welshon, Perennial Department Manager at Echter's Garden Center in Arvada, Colorado, and a master gardener for Jefferson County, has had a life-long love affair with plants, since her earliest days in the five acres of nursery and demonstration gardens of her family's business.

Dyssodia tenuiloba

by Pat Hayward

One would think a flower that blooms all summer and prefers it hot and dry would be a top seller in this region, but the word isn't out yet that Dahlberg daisy, *Dyssodia tenuiloba* (formerly known as *Thymophylla tenuiloba*) is a perfect annual for the high, dry plains.

This little annual has been called "dogweed" and "fetid marigold" in its native Texas, names that I'm sure haven't increased its popularity. Dahlberg daisy is rarely available at local garden centers, but someday this adaptable, ferny-leaved yellow daisy will rightfully compete with the best of the annuals.

Dahlberg daisy is a small-flowered, golden-yellow composite, native to south-central Texas and nearby Mexico. It is 4-6″ tall, self-sows, loves heat, and is a half-hardy annual tolerant of light frost. Its bright green, lacy foliage is both unusual in texture and functional, helping conserve water for this drought-tolerant plant.

There are many wonderful ways to use Dahlberg daisy. You might combine it with other little annual daisies such as *Chrysanthemum multicaule* (yellow daisy) and *C. paludosum* (white creeping daisy), and pink and blue Swan River daisy (*Brachycome iberidifolia*). It is one of the few annuals that can be mingled attractively into the rock garden, thanks to its small, natural-looking demeanor. One gardener I know lets Dahlberg daisy grow down through a dry wash in his rock garden because it provides color all summer long and is so drought-tolerant.

A professional grower I know has also fallen for the charms of this little annual. She likes to let the profuse bloomer trail over the edges of her raised beds. For a hot combination, she has grown it with bright pink *Verbena* x *hybrida* 'Romance.' Dahlberg daisy's golden-yellow flowers also look good with blue, whether it be the bright blue of *Salvia farinacea*, the paler blue of perennial blue flax, *Linum perenne*, or the lavender-blue of another American native, Tahoka daisy (*Machaeranthera tanacetifolia*).

So now that you want Dahlberg daisy in your garden, where to find it? Local growers say it is relatively easy to grow from seed, but some years seed has not been available. The few local retail sources that offer plants say they sell out in a matter of weeks, while wholesalers claim it is not big enough of a seller to warrant growing more of it. The Denver Botanic Gardens annual plant sale has offered it and will continue to do so in 1991.

A xeriscape annual. . . a trailing daisy. . . a ferny-leaved self-sower that loves the heat. . . Soon Dahlberg daisy will bloom in gardens all over the region from June until frost, just as the spring-blooming yellow daisies of hardy iceplant (*Delosperma nubigenum*) do now.

Pat Hayward is a perennial specialist at Little Valley Nursery in Brighton, Colorado. She writes and teaches extensively and has championed the use of water-efficient plants in regional landscapes.

Dahlberg daisy (*Dyssodia tenuiloba*) is a dainty yet robust little native daisy perfect for sunny, dry gardens.

Robert E. Heapes

Ipomopsis rubra, a native biennial, attracts both people and hummingbirds with its tall, long-blooming red spikes.

At Denver Botanic Gardens, this berm covered in brilliant, drought-tolerant *Verbena tenera* and *V. tenuisecta* was one of the highlights of the 1990 displays.

Lauren Springer

The rich colors of tuberous begonia (*Begonia* x *tuberhybrida*) and *Coleus* x *hybridus* lend a tropical feeling to a shady corner.

The double sunflower *Helianthus annuus* 'Goldburst' proved to be a winner in the 1990 Annual Trials at Denver Botanic Gardens.

Verbena tenera and *Verbena tenuisecta*

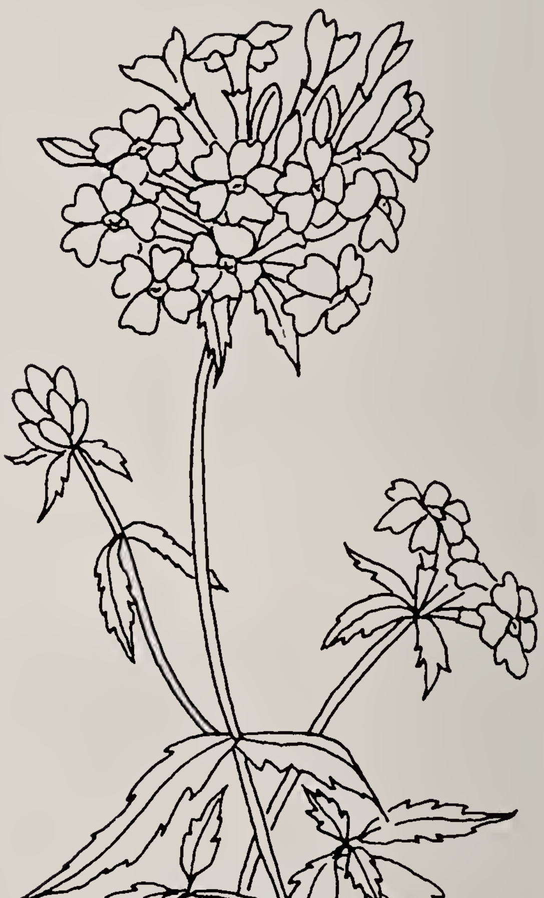
by Jim Knopf

Last year, a xeric planting at Denver Botanic Gardens stole the show as one of the most colorful and pleasing designs there. This delightful, water-efficient mix of perennial grasses, native shrubs and two verbenas, *Verbena tenera* and *V. tenuisecta,* was a huge hit on the steep berm near the annual trial beds.

Both verbenas are tender perennials of South American origin, to be grown as annuals here, and have proven to be highly tolerant of heat and drought. Their spreading habit creates a thick yet finely-textured groundcover; their profuse flowering, in complimentary scintillating lavender (*V. tenuisecta*) and bright rose (*V. tenera*), continues from June through most of autumn, even after several light frosts, before tapering off in mid-October. That's a considerably longer period of color than many traditional annuals can provide, and the Denver Botanic Gardens planting thrived on less than one-half inch of irrigation every other week in rainless midsummer Denver weather.

The verbena carpet was the idea of former Gardens horticulturist Gayle Weinstein. The steep area had always been difficult to irrigate and the soil is typical "Denver adobe"—heavy clay, a common regional challenge. The verbenas were tested in a different location before going in *en masse* on the slope. They were propagated from cuttings. Both verbenas can be raised from seed as well.

Verbena tenuisecta is slightly smaller in height and spread than *V. tenera* and has more finely dissected foliage. The plants make lovely hanging baskets and have white forms for the gardener who shies away from pinks and purples. Clearly, dry doesn't have to be dull. Verbenas are just one example of the many annuals and perennials with colorful potential in the dry garden.



Shirley Nelson

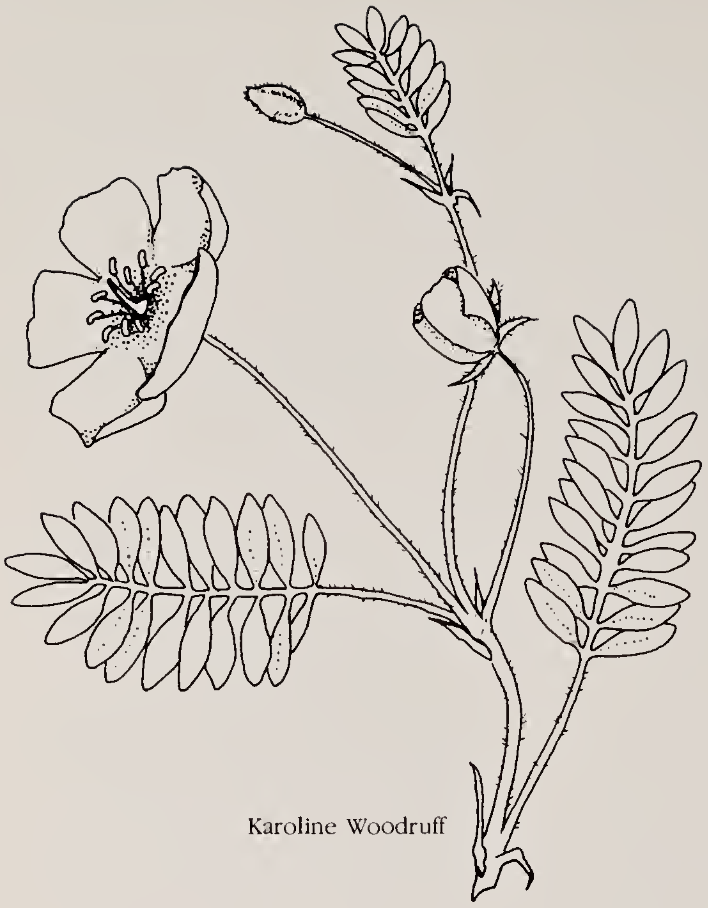
Jim Knopf, a landscape architect based in Boulder, teaches and writes about how to create beautiful gardens with tough, attractive plants. He is working on a book about waterwise flower gardening for the Rocky Mountain region.

Annuals and Biennials That Need Little Water

L: low water requirement, about 1/2″ every other week
M: moderate water requirement, about 3/4″ weekly

Agrostis nebulosa cloud grass L-M
Alcea rosea hollyhock M biennial
Ammi majus Queen Anne's lace L-M, cool weather
Antirrhinum majus snapdragon M
Argemone spp. prickly poppy L
Atriplex hortensis 'Rubra' red orach L-M
Baileya multiradiata desert marigold L
Borago officinalis borage M
Brachycome iberidifolia Swan River daisy L-M
Calandrinia umbellata rock purslane L, cool weather
Calendula officinalis pot marigold M, cool weather
Catharanthus roseus Madagascar periwinkle L-M
Centaurea cyanus bachelor's button M
Cheiranthus allioni Siberian wallflower M, fragrant, biennial
Cleome hasslerana spider flower M
Cleome serrulata Rocky Mountain bee plant L
Consolida ambigua larkspur L-M
Coreopsis tinctoria calliopsis L-M
Cosmos bipinnatus pink cosmos L-M
Cosmos sulphureus yellow cosmos L
Crepis rubra hawk's beard L-M, cool weather
Daucus carota Queen Anne's lace M, cool weather, biennial
Dianthus chinensis annual pinks L-M
Diascia spp. twinspur L-M
Dimorphotheca pluvialis Cape marigold L-M
Dorotheanthus bellidiformis Livingstone daisy L
Dyssodia tenuiloba Dahlberg daisy L
Echium lycopsis viper's bugloss L-M cool weather
Emilia javanica tassel flower L-M
Erigeron karvinskianus Mexican fleabane L-M
Eschscholzia californica California poppy L
Euphorbia marginata ghostweed L-M
Felicia amelloides blue marguerite L-M, cool weather
Foeniculum vulgare fennel L-M, fragrant
Gaillardia pulchella annual Indian blanket L-M
Gazania rigens treasure flower L-M
Glaucium flavum horned poppy L, biennial
Gomphrena globosa globe amaranth L-M
Gypsophila elegans annual baby's breath M, cool weather
Hedysarum coronarium french honeysuckle L-M, fragrant
Helianthus annuus sunflower M
Hordeum jubatum squirrel-tail grass L-M
Hunnemannia fumariifolia Mexican poppy L
Ipomopsis aggregata sky rocket L
Ipomopsis rubra standing cypress L, biennial
Kochia scoparia burning bush L-M
Lagurus ovatus hare's-tail grass L-M
Lathyrus odoratus sweet pea L-M, cool weather, fragrant
Layia platyglossa tidy-tips L, cool weather
Lavatera trimestris shrub mallow L-M
Limonium sinuatum statice L-M
Linaria maroccana toadflax L, cool weather
Linum grandiflorum annual flax L-M, cool weather
Linum usitatissimum annual blue flax L-M, cool weather
Lobularia maritima sweet alyssum L-M, fragrant
Machaeranthera tanacetifolia Tahoka daisy L
Mentzelia decapetala blazing star L
Mesembryanthemum crystallinum ice plant L, cool weather
Mirabilis jalapa four o'clock L
Nigella damascena love-in-a-mist L-M
Nolana paradoxa L
Oenothera spp. evening primrose L-M, some are fragrant
Onopordum acanthium scotch thistle L-M, biennial
Papaver nudicaule Iceland poppy L-M, fragrant, cool weather
Papaver rhoeas Shirley poppy M
Papaver somniferum sleepy poppy L-M
Pennisetum setaceum fountain grass L-M
Pennisetum villosum feather top L-M
Perilla frutescens beefsteak plant L-M
Phacelia campanularia desert bluebells L
Phlox drummondii annual phlox L-M, fragrant, cool weather
Portulaca grandiflora L-M
Rhynchelytrum repens ruby grass L-M
Rudbeckia hirta black-eyed susan M
Salvia coccinea scarlet Texas sage L-M
Salvia farinacea blue sage L-M
Salvia sclarea clary sage L-M, fragrant, biennial
Sanvitalia procumbens creeping zinnia L-M
Senecio cineraria dusty miller L-M
Setaria italica foxtail millet L-M
Silene armeria pink catchfly L
Silybum marianum milk-thistle L-M, biennial
Tagetes spp. marigold M
Thelesperma burridgeanum L
Tithonia rotundifolia Mexican sunflower M
Trachymene coerulea blue laceflower L-M, cool weather
Tropaeolum majus nasturtium L-M fragrant
Ursinia anthemoides L cool weather
Venidium fastuosum Cape daisy L-M
Verbascum spp. mullein L-M, biennial
Verbena spp. L-M
Xeranthemum annuum immortelle L-M
Zinnia angustifolia narrow-leaf zinnia L-M
Zinnia haageana Mexican zinnia L-M

Ruth Harold


Karoline Woodruff

Kallstroemia grandiflora

by Ray Daugherty

Last summer while visiting Arizona and New Mexico, I came across an annual I had never seen in Denver gardens but that would be a worthy addition to the dry cottage garden.

I found the plant growing along sunny, well-drained roadsides in the mountains of eastern Arizona. You can imagine my joy when I thought I'd found an apricot-flowered callirhoe, or prairie wine-cup. Later a friend identified the specimen I'd taken as *Kallstroemia grandiflora*. Although given the name Mexican or desert poppy and resembling a mass of apricot California poppies (*Eschscholzia californica*), this six- to eight-inch tall, sprawling annual vine is actually a member of the caltrop, or Zygophyllaceae family, known for the weedy puncture vine, *Tribulus terrestris*. I've been assured, however, that the fruit of the Mexican poppy is not nearly as likely to inflict pain as that of the puncture vine, and that this plant is quite worthy of inclusion in a xeric or wildflower garden.

Although I am not usually a fan of orange in the garden, the apricot-hued Mexican poppy inspired me to concoct many a potentially happy combination for it in regional gardens. It seems tailor-made for inclusion in a naturalistic border with such native perennials as yellow *Zinnia grandiflora*, the red and bi-colored forms of Mexican hat (*Ratibida columnifera*) or Indian blanket (*Gaillardia* x*grandiflora*), or with the white flowers of *Oenothera caespitosa* and *Eriogonum niveum*, adding the silver foliage of *Artemisia* species.

Other drought-tolerant annuals to romp alongside the apricot Mexican poppy might include the brightly-toned daisies of *Gazania rigens*, the white or newly available orange globe amaranths (*Gomphrena globosa*), the tiny, profuse daisies of *Dyssodia tenuiloba* and rich blue *Phacelia campanularia*.

In combination with a more traditional selection of garden perennials, also sun-loving and quite tolerant of low-moisture conditions, *Kallstroemia grandiflora* might combine well with silver lamb's ears (*Stachys byzantina*), white hollyhocks (*Alcea rosea*), blue fescue (*Festuca ovina* 'Glauca'), blue avena grass (*Helictotrichon sempervirens*), and golden yarrow (*Achillea filipendulina*). As with all new and exciting plants, the possibilities for combination are virtually limitless.

At this time, sources for *Kallstroemia grandiflora* are limited:

Plants of the Southwest
930 Baca Street
Santa Fe, NM 87501

Southwestern Native Seeds
Box 50503
Tucson, AZ 85703

Native Seed
2073 E. ASU Circle
Tempe, AZ 85284

Ray Daugherty received his B.S. in landscape horticulture from Colorado State University. He is propagator at Green Acres Nursery in Golden, Colorado, where he has developed an extensive trial and display garden, and brings native and unusual plants into the trade.

Maurandya antirrhiniflora

by Ray Daugherty

I discovered the showy climbing snapdragon, *Maurandya antirrhiniflora*, in New Mexico last summer while visiting Plants of the Southwest, a nursery in Santa Fe. In the greenhouse, the beauty of several hanging baskets in full flower overwhelmed me. Imagine my surprise when I found this same plant (along with several other native maurandyas) listed in the 1991 Thompson and Morgan seed catalog, under the synonym *Asarina antirrhiniflora*.

This vining annual, with lovely leaves resembling a glaucous-green ivy geranium (*Pelargonium peltatum*), comes in two distinct color forms: a light violet blue and a ruby red, supposedly the more showy form. Both make beautiful hanging baskets, or they may be allowed to twine up a trellis or sprawl over the ground. Give climbing snapdragon average to dry conditions; the plant can take a variety of light and temperature conditions.

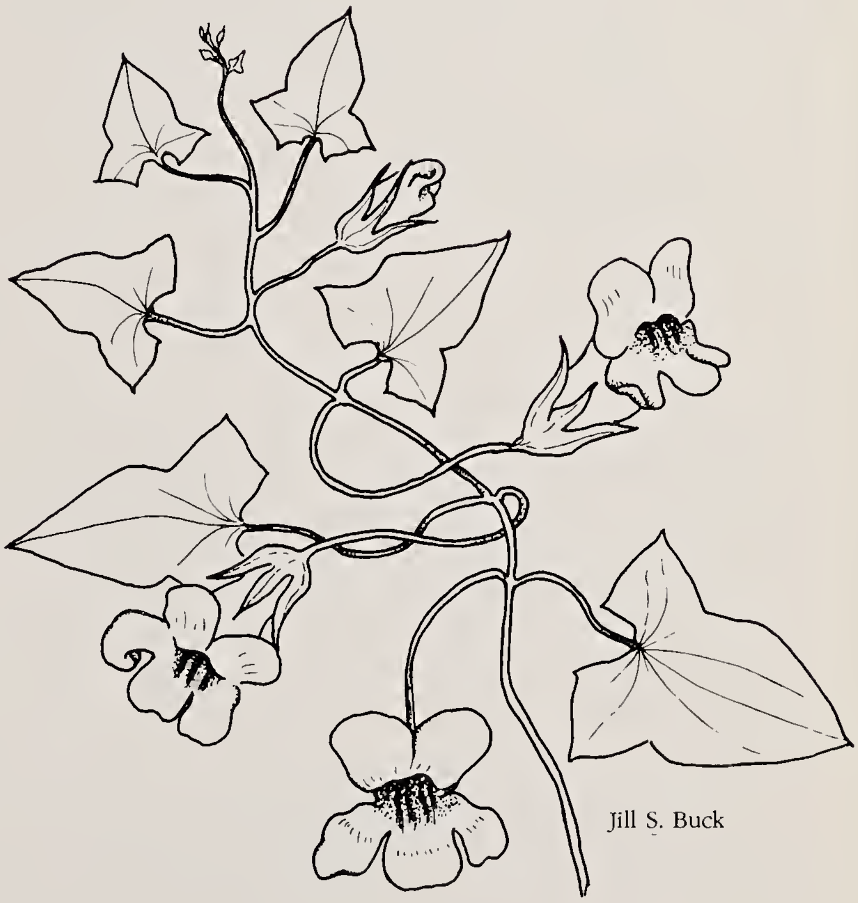
Perfect company for this plant might be other vining plants such as morning glory (*Ipomoea purpurea*) or hyacinth bean (*Dolichos lablab*) twining with it on a trellis behind white annual *Lavatera trimestris*. Perhaps allow it to twine through the stalwart perennial *Artemisia ludoviciana* 'Silver King,' or over a picket fence, or to meander among blue bachelor's buttons (*Centaurea cyanus*) and sweet alyssum (*Lobularia maritima*). Once seen, this beautiful native annual vine should stimulate even the most unadventurous gardener to find exciting uses for it.

Sources for *Maurandya antirrhiniflora* include:

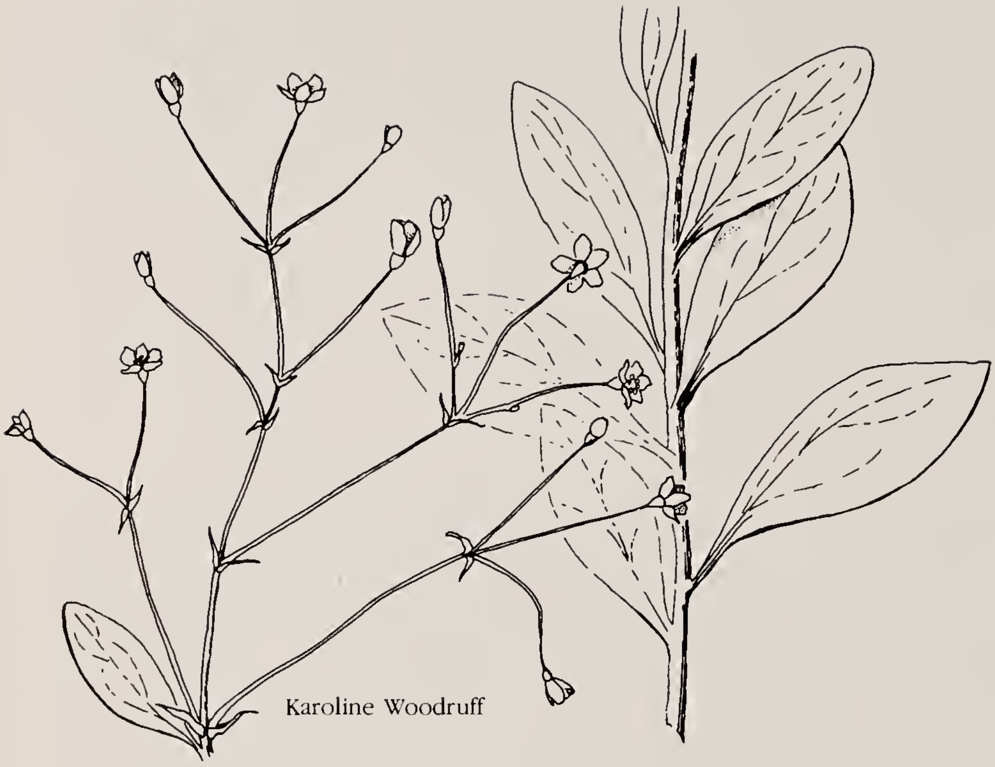
Plants of the Southwest
930 Baca Street
Santa Fe, NM 87501

Southwestern Native Seeds
Box 50503
Tucson, AZ 85703

Thompson & Morgan
P.O. Box 1308
Jackson, NJ 08527



Jill S. Buck



Talinum paniculatum

by Laura Lee Cutler

I came to gardening through a love of flower arranging. Even as a young girl in southern Colorado, I remember the pleasure of putting flowers in vases to place in our home. Once I had my own garden, I depended on roses and some perennials to give me that plentiful supply of flowers I wanted for arranging. But I soon discovered that I wanted more from the landscape, and found how much fun and variety annuals can add to the garden.

An out-of-the-ordinary plant I grow for interest in the garden and in arrangements is jewels-of-Opar or fameflower, *Talinum paniculatum*, also known as *T. crassifolium*. This dainty flower is native to the southern United States, Mexico and Central America, where it is perennial. In the harsher climate of my Denver garden, it acts as an annual, replenishing itself each year with a multitude of self-sown seedlings.

The foliage of jewels-of-Opar is glossy green, reminiscent in color and texture of *Euonymus kiautschovicus* 'Manhattan.' In late June, airy wands begin to grow above the foliage to a height of two feet or so. These are the flower panicles. The stems are maroon in color, with tiny buds all along them. When the buds open, a few at a time, there appear tiny pink florets. Often the buds, pink flowers and tiny orange seed pods appear on the panicle at the same time. This continues all summer long.

Talinum paniculatum likes a sunny location, is undaunted by heat and seems to withstand drought. It doesn't look its best massed together due to its dainty, open nature; a more effective way to grow it is to spot it here and there in the garden. It combines well with 'Purple Ruffles' basil (*Ocimum basilicum*), the short, variegated ribbon grass (*Phalaris arundinacea* 'Picta') and pink zinnias (*Zinnia elegans*). Dainty, fun and easy, *Talinum paniculatum* will reseed and bring you new plants for the garden and the vase each spring for many years.

Laura Lee Cutler is a native Coloradan and has gardened in Denver for thirty years. She is a consulting rosarian for the American Rose Society and grows a wide assortment of flowering plants in her garden.

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Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens · Fall/Winter 1991

Evergreens

Why Evergreens?

Mention the word "evergreen" and most people think of pine, fir or spruce trees. They are, after all, the most obvious plants in a winter landscape whether it be around a home, a park or a mountain vista.

This issue of *Mountain, Plain and Garden* features evergreens not only to show that they are much more than pines, firs and spruces but a wide array of plants with broad, flat leaves as well as scale-like and needle-like leaves, that vary in size from prostrate ground covers to shrubs and the tallest of trees.

At this time of year, evergreens take on special meaning. The Christmas tree, the garlands and wreaths made of holly, pine and fir boughs, symbolize, to many, the promise of life eternal. Unlike their deciduous counterparts, evergreens, when used in the home landscape, provide year-round evidence of life even when it is bitter cold and a gray, gloomy sky hangs overhead.

The articles in this issue have been written to describe the versatility that evergreens provide in a landscape. Some even present challenges for more avid gardeners.

As you read through this publication, keep in mind that it is not intended as a "monograph" of all possible evergreens but, rather, a careful selection by the authors, drawing from their knowledge and experience.

I hope you will find the information contained in this publication enjoyable as well as useful in your own gardening pursuits.

—James R. Feucht,
Extension professor, horticulture,
Colorado State University

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens

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On the cover, a mugo pine and blue spruces frame a year-round garden

cover photo: Alan Rollinger

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A Botanical History of Evergreens

Helen Zeiner

Evergreens fall into two categories—needle-leaved coniferous evergreens and broad-leaved evergreens. Coniferous evergreens are a well-defined, related group. Broad-leaved evergreens, on the other hand, are represented in different unrelated families. Both are useful in home landscaping.

Furthermore, coniferous evergreens are gymnosperms, which means “naked seed,” because the seeds are borne openly on cone scales rather than enclosed within an ovary as in the angiosperms, the group to which all the flowering plants belong.

The gymnosperms are an ancient group with a long geologic history. Fossil evidence indicates that needle-leaved coniferous evergreens first appeared hundreds of millions of years ago in the Paleozoic era. They evolved from the Cordiatales, which had large, strap-like leaves and whose seeds were loosely arranged in racemes instead of being compacted into cones. They reached the climax of their abundance during the Carboniferous period of the Paleozoic era and were an important part of the extensive coal deposits laid down at that time. Gradually they waned, but remained dominant plants for millions of years. Today, far fewer than in their zenith, they still constitute a group of great importance to man.

Angiosperms appeared in geologic history later than gymnosperms and are considered to be the most highly evolved of the seed plants. The broad-leaved evergreens are found in many different families of this group.

It’s an interesting quirk that a few coniferous evergreens, such as the larch *(Larix)* are deciduous; and, while needle-like leaves are dominant feature of conifers, a few such as the araucarias, which are widely distributed in the Southern Hemisphere, are relatively broad-leaved. The junipers have very small scale-like or awl-shaped leaves, with some, curiously, having needle-like leaves only on their juvenile growth. Juniper berries are actually fleshy-scaled cones.

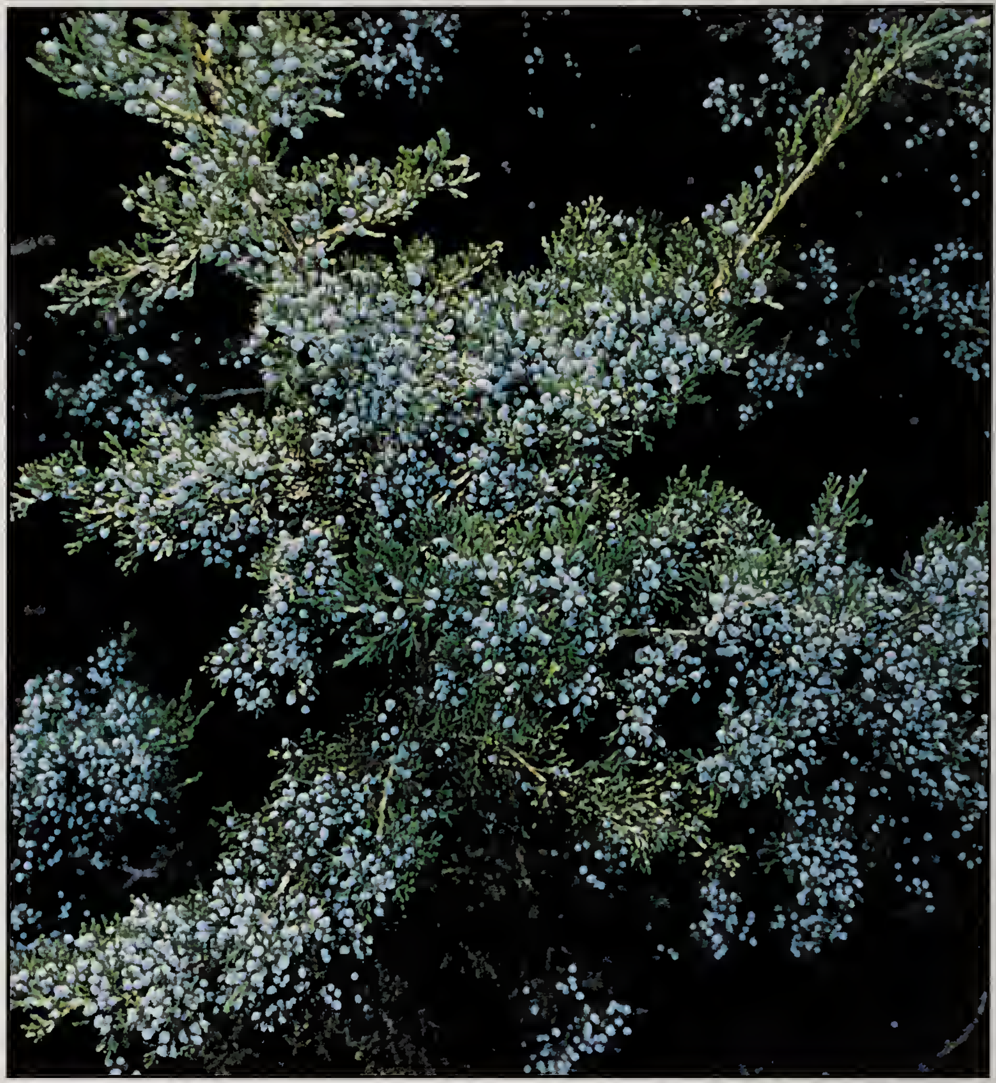
Though depleted by the activities of civilization, coniferous evergreens still form extensive forests across northern North America and Eurasia, with extensions occurring southward in the mountains where climatic conditions are similar to those of northern latitudes. Engelmann spruce forests just below timberline and Douglas-fir and ponderosa pine forests at lower elevations are prominent features of the Rocky Mountains in Colorado.

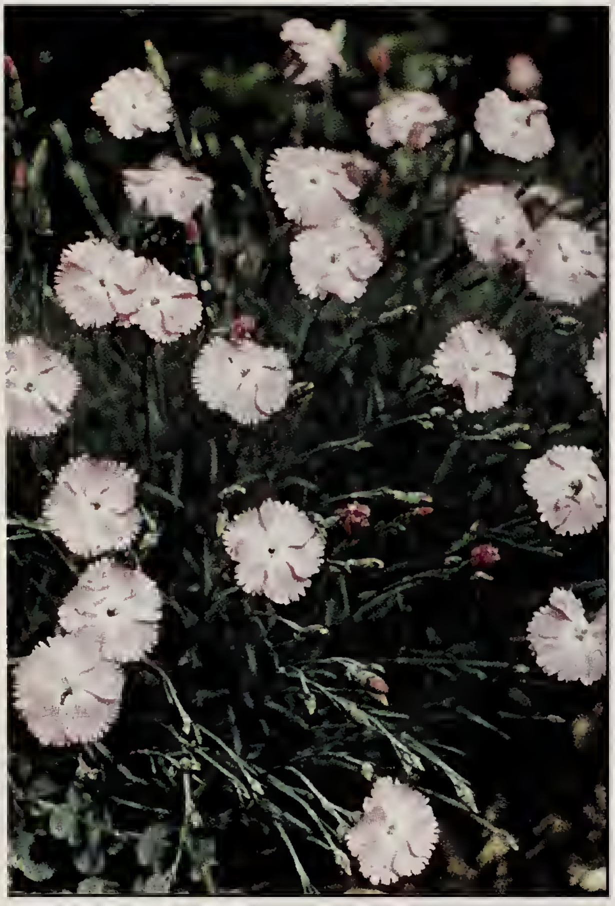
Evergreens are well adapted to cool climates with very cold winters and short growing seasons. Their needle-like leaves are protected from freezing and dehydration by a waxy cuticle with underlying layers of thick-walled cells. In some, starch changes to sugar in the coldest months to prevent their cell contents from freezing. Chlorophyll is present the year around, and food manufacture can take place whenever conditions permit.

Conifers are of great importance both ecologically and commercially. Great lumber industries are based on needle-leaved evergreen trees. There are also many ornamentals among the conifers, ranging from specimen trees to shrubs. ❧

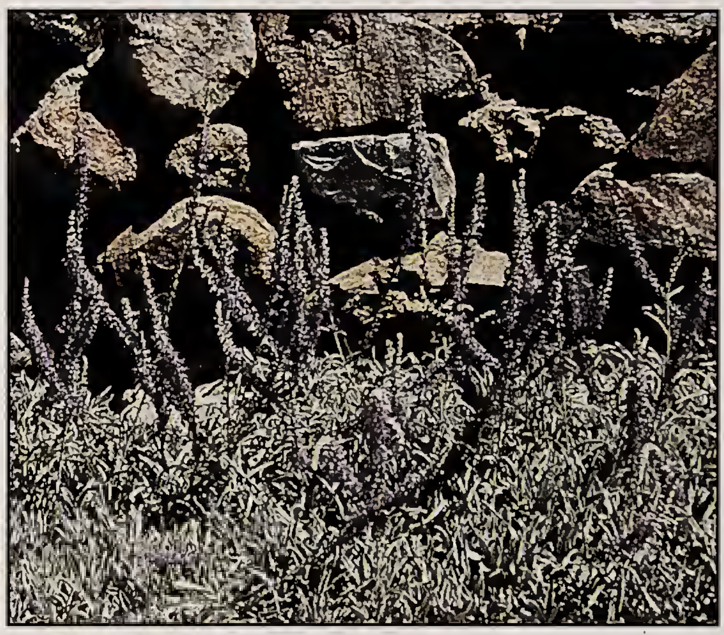
Helen Zeiner is honorary curator of the Kathryn Kalmbach Herbarium of Denver Botanic Gardens.

Usually not considered among the evergreens, many perennials keep their leaf color all winter long. Below, grass pinks, *Dianthus plumarius*.

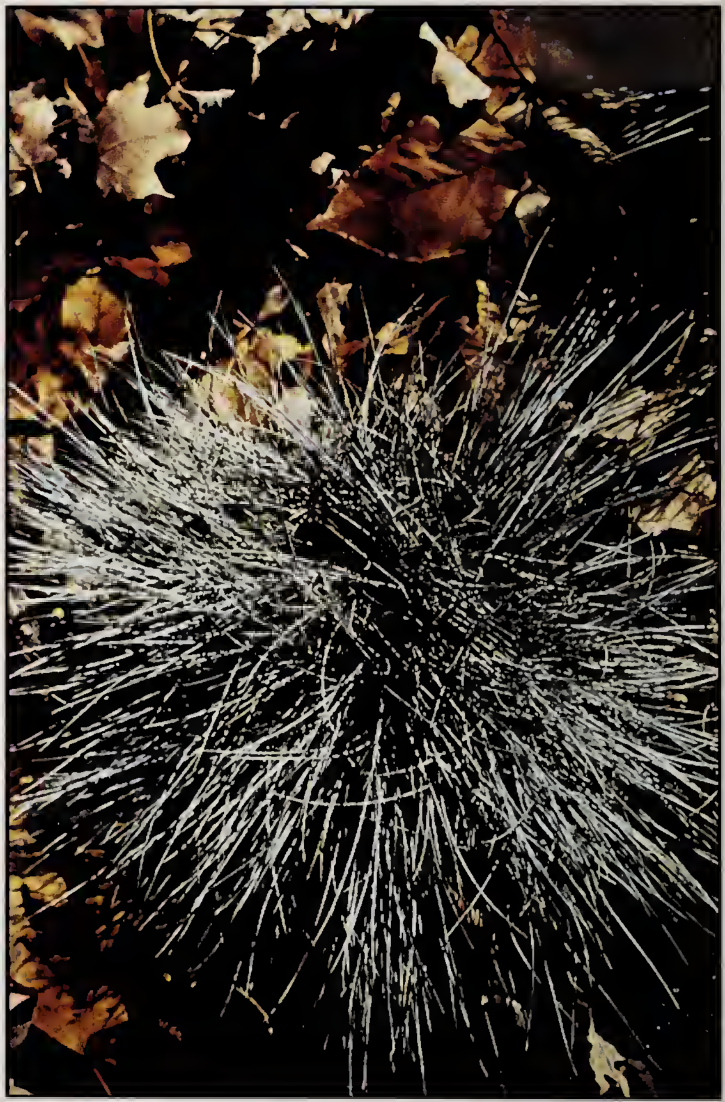




Andrew Pierce



Diane Ipsen



Top right, the variety 'Canaertii' of the common Virginia juniper enlivens the xeriscape with exceptionally plentiful fruit.

Above, *Veronica incana* is an evergreen perennial suitable as a ground cover in dry locations.

Right, another non-traditional evergreen, blue fescue, *Festuca ovina glauca*, is a striking non-spreading perennial grass.

Using Conifers in a Xeriscape

Curtis E. Swift

The term "xeriscape" is used to define landscaping that, among other things, takes advantage of placing together in the same area plants that need the same amount of water. This gives you the capability of irrigating plants in "zones" according to their water needs. As a result, you can significantly reduce your use of water and still prevent water stress in your plants. Properly arranged, plants that need more water than others can be irrigated adequately without over-irrigating low-water requiring plants at the same time. For example, junipers, which generally require little water, should not be planted in the same area as spruces, which thrive only with abundant moisture. While these are sometimes seen growing successfully side by side, it is more common to see one or the other suffering. Either the juniper turns yellow from the inside, due to the high soil moisture provided the spruce, or the inner needles of the spruce take on a purple-to-brown cast, due to little moisture given to the juniper.

Several years ago a contractor in the Grand Junction area installed thousands of dollars worth of trees and shrubs in a shopping mall. Within a couple of months the majority of these plants were dead. The landscaping contract had been awarded to the low bidder, and, to cut corners, the contractor eliminated soil amendments necessary for the heavy clay soil. Also, he installed a sprinkler system that did not take into account the need to zone the shrub beds and turf separately. While the heavy, tight soils should have been amended with organic matter to improve air infiltration, the death knell for the trees and shrubs was a sprinkler system that watered lawngrass in the same zone. As a result, the roots of the shrubs and trees rotted, while the new turf flourished.

Proper planning, as with all landscape endeavors, is critical to success in using evergreens in a xeriscape. To zone evergreens, you need to know their water requirements. This information, however, is not readily available.

A list of "drought-tolerant" conifers was put together by Steve Flickinger in the late 1970s (Stephen Flickinger, "Drought Tolerant Plants for the Pikes Peak Region," CSU Cooperative Extension, El Paso County). Flickinger's literature review separated trees and shrubs into the various water regimes needed to successfully establish them.

Curtis E. Swift is the Grand Junction, Colorado, area extension agent for horticulture in the Colorado State University Cooperative Extension Service, where he has developed innovative horticultural programs that include Xeriscaping. He has written numerous publications for the extension service and articles for trade journals and gardening magazines.

His rule of thumb for watering to establish coniferous shrubs is as follows:

1st year

- Once every 14 days for 8 weeks
- Once every 14 to 21 days after 8 weeks
- Once a month during the winter

2nd year

- Once every 14 to 21 days during the growing season
- Once a month during the winter

3rd year

- Once every 21 days
- Once a month during the winter

4th year

- Generally never; however, in extreme drought, once a month
- Once a month during the winter

Flickinger's rule of thumb for establishing coniferous trees is:

1st year

- Once every 21 days for 6 weeks
- Once a month after 6 weeks
- Once a month during the winter

2nd & 3rd year

- Once every month

4th year

- Generally never; however, in extreme drought, once every month

Consider these recommended irrigation schedules only as general rules of thumb. Sandy soils require more frequent irrigation, whereas clay soils generally require less frequent. The way to determine the actual need is to dig near the plant roots, check the soil moisture and apply water accordingly.

Regardless of the type of watering schedule you are on, note that Flickinger recommends watering on an infrequent basis. It should also be done deeply. This is nearly impossible, for the health of the grass, if your evergreen trees and shrubs are in the same zone as the turf.

While the general guidelines above indicate that, typically, no water is necessary the fourth year and beyond, Flickinger noted that some authors recommend up to four irrigations each year for established evergreens. Some woody ornamentals were reported to require no supplemental irrigation (see Table, page 7).

Listings such as Flickinger's provide pitfalls, especially when we consider that some of the publications used to compile his list were written in the eastern United States where a drought is considered to occur when the precipitation drops from 40 inches to 20 inches in a year. Many areas of Colorado's Front Range receive in a normal year no more than 15 inches. In the Grand Junction area, the average annual precipitation is less than 8 inches, well below what many Eastern authors consider a severe drought.

Another way to separate drought-tolerant plants is by considering their tolerance for salts in the soil. Sometimes you can assume that the higher their salt tolerance, the more drought-tolerant they are. Mary Graves, a former Tri-River Area master gardener, compiled several lists of salt-tolerant plants which included evergreens (*Ornamentals & Their Salt Tolerance,* compiled by Mary McNertney-Graves, CSU Cooperative Extension, Tri-River Area). This compilation has serious drawbacks. In many of the references the actual salt level in the soil was not tested. In addition, the concentration of salts changes, and there is no way to know if each soil sample was collected when the plant was being subjected to its highest level of salts. Soil salt concentrations tend to fluctuate depending on the amount of moisture in the soil. In western Colorado a dry winter increases soil moisture evaporation and the movement of soluble salts into the upper levels of the soil. Salts accumulate on the soil surface and are very obvious after a dry spring. If the spring is wet, the salts dissolve and are taken downward to below the root zone, so salt levels vary with the depth of the soil. A sample tested for salts would average these concentrations and not necessarily reflect the true salt level to which the absorbing roots of the plant are actually exposed.

However, regardless of the problems with accepting the salt-testing technique, Graves' list provides support for Flickinger's.

The Sunset Western Garden Book (Sunset Publishing Corporation, Menlo Park, California, 1990) provides further support by including pines in their list of drought-tolerant plants. They indicate that many pines will thrive with little or no water during a normal dry season, once they are established.

One final thought: When you plant evergreens in a xeriscape (or even in a conventional landscape) and you have considered the water requirements of all your plants, remember that many trees and shrubs have far-reaching root systems and, while the plants may not be side by side in the landscape, their roots may become intertwined.

The lists provided by Flickinger and Graves should serve as your guide, because mixing plants of different water needs may turn your landscape dream into a headache of stressed, diseased and insect-infested plants. ❧

Conifers for xeriscape plantings.

Needing supplemental water at least four times per year after establishment

Norway spruce	*Picea abies*
Japanese yew	*Taxus cuspidata*

Needing supplemental water at least twice per year after establishment

Eastern red cedar	*Juniperus virginiana* varieties
White spruce	*Picea glauca densata*
Colorado spruce	*Picea pungens*

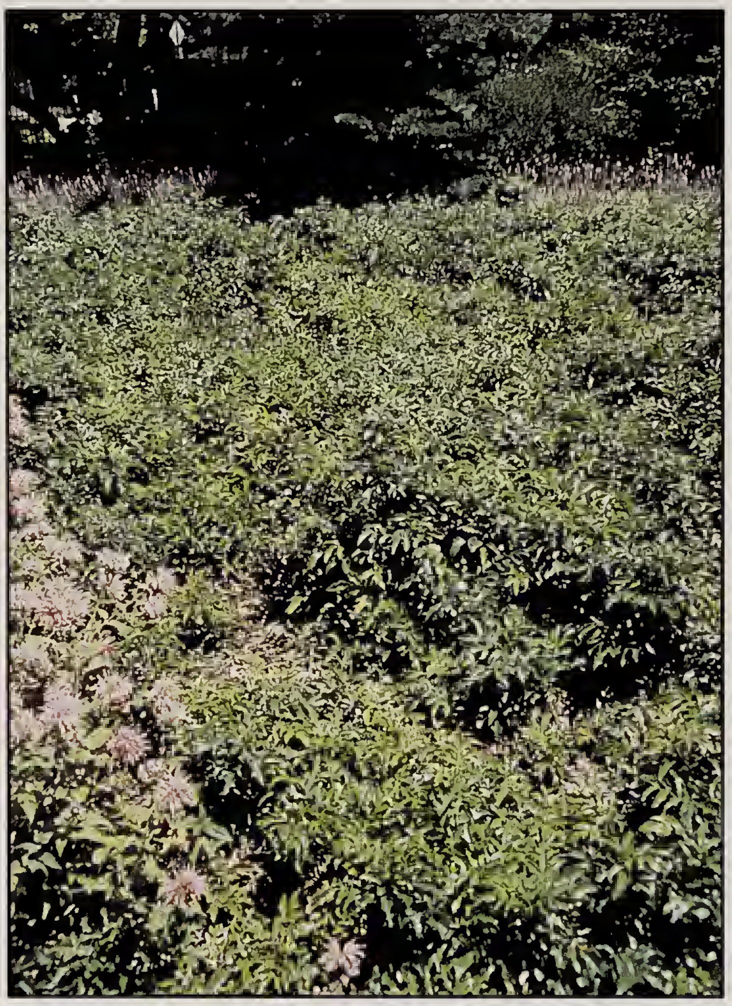
Needing supplemental water every two years after establishment

Jack pine	*Pinus banksiana*
Swiss stone pine	*Pinus cembra*
Tanyosho pine	*Pinus densiflora unbraculiafera*
Limber pine	*Pinus flexilis*
Korean pine	*Pinus koraiensis*
Japanese white pine	*Pinus parviflora*
Pitch pine	*Pinus rigida*
Eastern white pine	*Pinus strobus*
Scots, or Scotch pine	*Pinus sylvestris*
Japanese black pine	*Pinus thunbergii*
Virginia pine	*Pinus virginiana*

Needing no supplemental water after establishment

Chinese juniper	*Juniperus chinensis* varieties
Common juniper	*Juniperus communis*
One-seed juniper	*Juniperus monosperma*
Japanese garden juniper	*Juniperus procumbens*
Savin juniper	*Juniperus sabina* varieties
Rocky Mountain juniper	*Juniperus scopulorum* varieties
Utah juniper	*Juniperus utahensis*
Bristlecone pine	*Pinus aristata*
Pinyon pine	*Pinus edulis*
Lodgepole pine	*Pinus contorta latifolia*
Limber pine	*Pinus flexilis*
Mugo pine	*Pinus mugo*
Austrian pine	*Pinus nigra*
Ponderosa pine	*Pinus ponderosa*
Southwest white pine	*Pinus strobiformis* (*P. flexilis reflexa*)

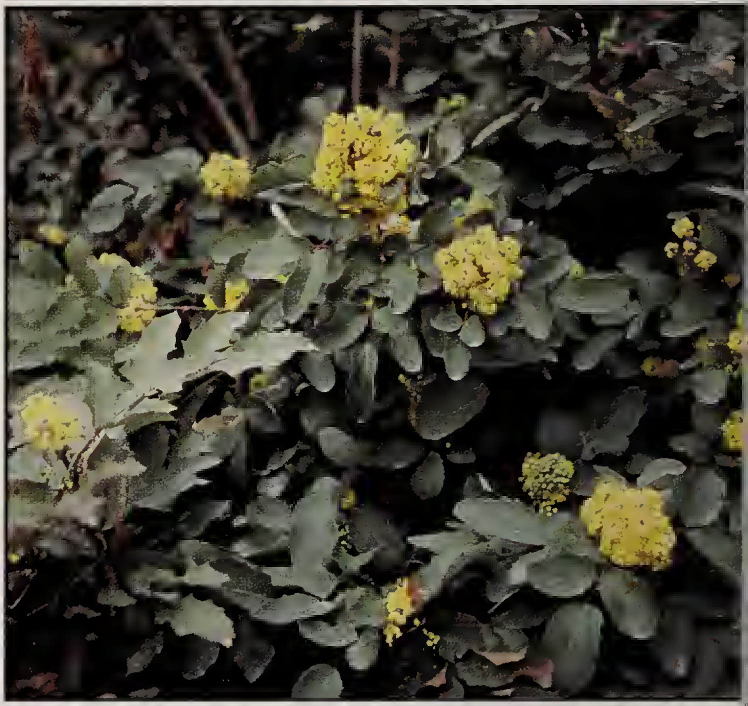
Doris Peacock



Diane Ipsen

Left, *Mahonia aquifolium* 'Compactum'

Below, *Mahonia repens* in flower



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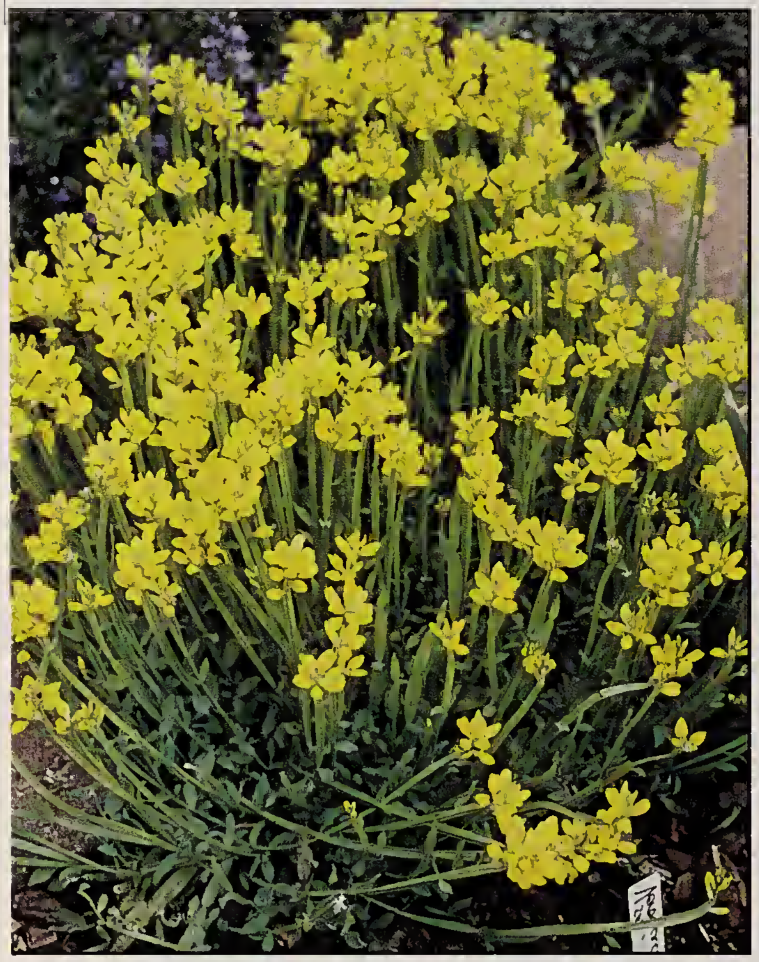

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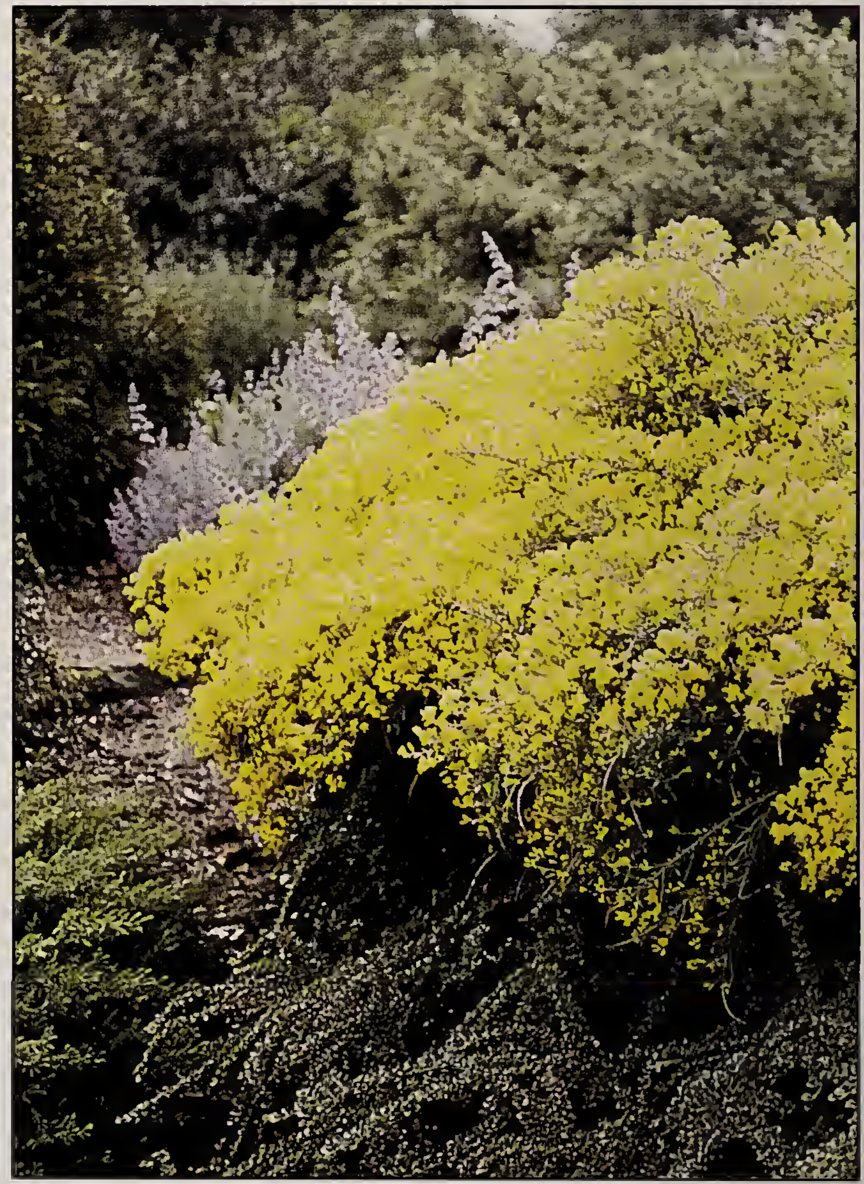

Above, *Genista pilosa*

Right, *Cytissus* species

Broad-leaved Evergreens

Larry Watson

In horticulture we refer to plants that are not conifers, but that hold their leaves through the winter, as broad-leaved evergreens. In the High Plains our ability to grow this group of plants is, at best, a challenge and, at worst, a frustrating experience.

Taylor's Encyclopedia of Gardening states, outright, that, "They (broad-leaved evergreens) do poorly or cannot be grown at all in regions where the annual rainfall is below 20 inches." The lack of sufficient moisture, as well as our low humidity, contributes to the difficulty in growing these plants. Add to these our hot winter sun and the rapid changes in temperature, both day to night and day to day, and our task—or challenge—increases. But in spite of these difficulties, there are a number of broad-leaved evergreens that we can grow with success in the Rocky Mountain region.

There are several species and selections we can choose from the genus *Euonymus. E. fortunei* and many of its varieties seem to do quite well. The purple-leaf wintercreeper, *E. fortunei* 'Coloratus', can be used both as a wall cover and a ground cover. This plant has dark green leaves in the summer which turn plum-color in fall and winter. Like some other varieties, this plant has a trailing or climbing habit. When used as a ground cover, an annual pruning will help to keep the plant from getting stringy.

The leaves of *E. fortunei* 'Sarcoxie' stay green all winter. If it is planted so that it can stand alone it will grow into a shrub about 4 feet tall and 3 feet wide. If, however, it is planted near a wall or fence it will climb or lean. This plant is one of the hardiest. More easily found at the nurseries and garden centers today is *E. f.* 'Green Lane'. As the Lake County (Ohio) Nursery catalog says, "It is superior in every way to *E. sarcoxie* (sic) and *E. vegetus* (sic), and yet intermediate between the two. The thick, lustrous, dark green leaves do not winter burn, but stay bright and fresh throughout the entire year. The plant can be grown as a shrub, creeper or climber like *E. f.* var. *vegetus,* and in the fall will be speckled with appealing, bright orange berries."

There are a large number of yellow-and-green and white-and-green selections of *E. fortunei.* My experience with them indicates they all grow well here. The green-and-gold selections need to be planted in the sun to retain their coloration. This does not seem to be true of the white-and-green selections. Some of the better green-and-gold selections are 'Canadale Gold', a Canadian Ornamental Plant Foundation introduction; 'Emerald 'n Gold' and 'Golden Prince'. Of the green-and-

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Larry Watson, a graduate of Colorado State University and formerly an extension horticulturist in Jefferson County, managed Western Evergreens and Little Valley Wholesale Nurseries, both on the Front Range. He is an honorary life member of the Colorado Nurserymen's Association and a champion of unusual plants in regional landscapes, especially plants from the semi arid West.

white varieties, I would suggest 'Emerald Gaiety' and the smaller *E. f.* 'Argenteo-marginatus'. The variety 'vegetus' is a very vigorous trailing wall cover. It is also known for its production of abundant fruit.

Another euonymus which is little-used but of great value is one I have known as *E. turkestanicus nanus*, but which may more correctly called *E. nana* var. *turkestanicus.* This species has wiry stems and narrow leaves and is usable as a 12-to-18-inch ground cover. It should be pruned periodically to keep it full and bushy.

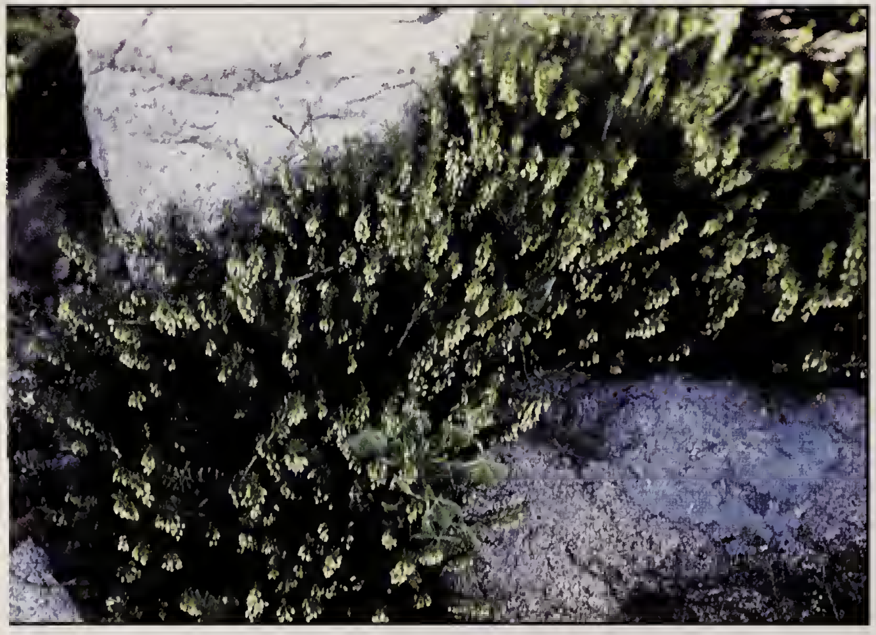
The most common of this group of evergreen euonymus I have left for last—I feel it is the least hardy of all: *E. kiautschovicus* 'Manhattan', or Manhattan euonymus. Of course, it is also the most widely sold of all. The last two winters have taken their toll on these plants, and although it is possible that we will not see this kind of damage again for several years, when it is cold enough we will see this damage repeated. *(Damage did, indeed, occur to this cultivar in October, 1991, after this article was written.—J.F.)*

The genus *Mahonia* also has two species for us to consider. The first is the dwarf grape holly, or dwarf Oregon grape, *Mahonia repens.* Native to the Rocky Mountains, in the wild it is seldom seen taller than 1 foot; however, in some Denver gardens I have seen it 2 to 3 feet tall. It spreads by underground stems and makes a very dense ground cover. The foliage of this mahonia is not as glossy as that of *M. aquifolium* (which I will discuss next) yet of good solid green in summer. Its new leaves emerge with a purple and bronze tinge, then turn purple and bronze again in the fall. Its yellow flowers are followed by blue fruit. This is one of our most reliable broad-leaved evergreens.

The other species, *Mahonia aquifolium,* will grow slowly to 8 feet tall. It also has leaves that are bronze, copper or reddish when they unfold. Then they turn shiny green, to regain their spring color in the fall. Fruits of these plants are similar to those of the dwarf grape hollies. Because they are usually grown from seed they vary greatly in height. A selection of this species, grown from cuttings, is *Mahonia aquifolium* 'Compacta'. Plants of this grow uniformly to 4 feet. All mahonias should be planted in sheltered positions, at least out of winter wind and sun.

The fire thorns (genus *Pyracantha*) also hold some promise for our use. They have white flowers which, late in summer, turn into orange or red fruit. They are a vigorously growing group and can get a bit unwieldy if not pruned regularly; I think they should be considered 4- to 10-feet-tall plants.

Although they are not very shade-tolerant they should be planted where they receive protection from winter wind. They

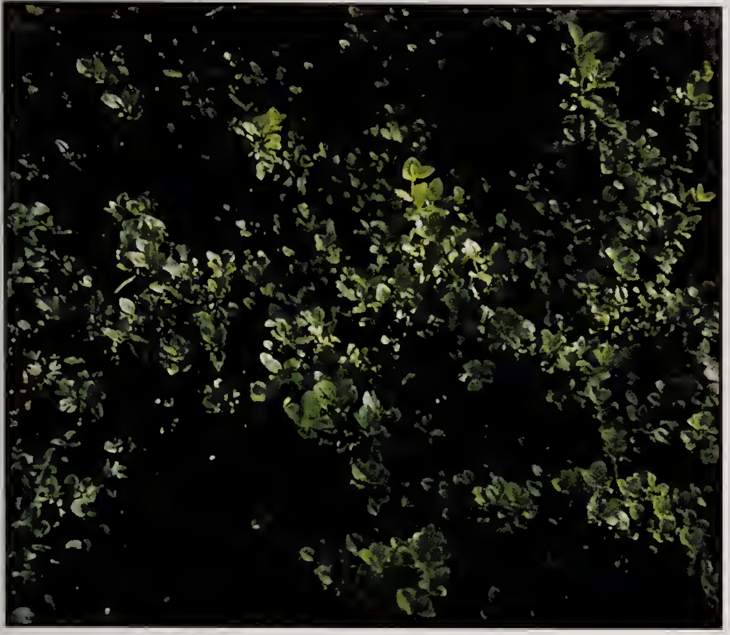


Andrew Pierce

Erica hederacea

Andrew Pierce

Daphne x Somerset



Euonymous fortunei 'Vegetus'

Paul Maslin

Cytissus x Kewensis

also require a moist soil, especially in winter. The species *P. coccinea* has been used here more than others, the varieties 'Wyattii', 'Kasan' and 'Pauciflora' being offered most often. Although Monrovia Nurseries in California lists *P. angustifolia* 'Yukon Belle' as the hardiest, and it has been sold in Denver for many years, I still cannot verify its hardiness. Books list *P. angustifolia* (as a species) as less hardy than *P. coccinea.*

Over the years most of our broad-leaved evergreens have come from these three groups of plants. In the past five years or so, some other plants have come to our attention. Experimental plantings at Denver Botanic Gardens and some nurseries in the area suggest a few more recommendations.

It was long thought that none of the true hollies (in the genus *Ilex*) could be grown here. That was before we knew about the "blue" hollies, *Ilex* x *meserveae.* As their names imply, these have very distinctive, bluish foliage. They have small white flowers in the spring, and the female plants bear fruit. You must always plant both male and female plants in order to get fruit: Male and female flowers are on separate plants.

This group of hollies came about through a series of crosses between *I. rugosa* and *I. aquifolium* by Mrs. Kathleen K. Meserve of New York. We tried the first of these in the mid-1970s. They have proven to be very hardy and have performed quite well here. There are now many selections available from these original crosses. All appear to be very slow-growing and may take a long time to reach the sizes cited in references.

Another holly for our area is the ink berry, *Ilex glabra.* Ink berries have lustrous, smooth, dark green leaves without the spiny margins characteristic of many hollies. The fruits on female plants are black. I was first introduced to this holly at Denver Botanic Gardens; it has been a pleasant surprise to watch these plants do well. The Gardens grows the cultivar 'Nordic'. Rated by the USDA as a zone 3 plant, it can be expected to grow to 3 or 4 feet. It does best in moist soil.

As with the true hollies, rhododendrons, too, were thought to be difficult—if not impossible—in Colorado. However, a hybrid named 'PJM', developed by the Weston Nurseries in Massachusetts, has proven to be among the hardiest of rhododendrons and quite reliable here. These evergreen shrubs flower in May with loose trusses of tubular, hot lavender-pink blossoms. There are similar selections now available with compact shapes or with pink or white flowers. 'PJM' rhododendrons flower better if they are protected from winter sun.

Several species and cultivars of the genus *Daphne* do surprisingly well in the Denver area. They are mostly small- to medium-sized shrubs with compact growth habit. Typically, they grow to about 3 feet high, slightly more across. Sweetly scented flowers appear profusely in the spring and, occasionally, in the fall. One of the most ornamental is *Daphne* x *burkwoodii* 'Carol Mackie'. whose dark green leaves have narrow margins of creamy white. Daphnes grow best in moist but well-drained soils where they receive light shade.

Hardy clones of boxwood, or "box," in the genus *Buxus,* are becoming more common in local gardens. Most do best in shady locations protected from drying winds. Few broad-leaved shrubs can compete with these plants' dense shape and ability to withstand heavy pruning and shaping. Denver Botanic Gardens has grown a variety of common box, *B. sempervirens* 'Vardar Valley', for a number of years. The little-leaf box, *B. microphylla* var. *koreana,* although hardier than the common box, is considered inferior by some horticulturists because of their lighter green foliage that has a tendency to discolor during cold weather. Hardy cultivars are 'Winter Gem' and 'Wintergreen'. Hybridization between these two species has resulted in improved cold hardiness and better foliage color in such varieties as 'Green Gem', 'Green Mountain' and 'Green Mound'.

The previously discussed broad-leaved evergreens originated in climates generally milder than ours, with richer soils and greater rainfall. However, native plant enthusiasts and xeriscape gardeners will be happy to learn of some broad-leaved evergreens from our own region that are better adapted to our temperatures, rainfall and soils.

Sticky laurel, *Ceanothus velutinus,* is one of these. It is a spreading shrub to 3 feet tall, commonly found on dry slopes in the Colorado foothills. Its leathery leaves are medium green, oval shaped, about ¾ inch long. It has small clusters of creamy white flowers in spring.

Also, two similar species of mountain mahogany, native to western Colorado, have evergreen foliage. Confusingly, both are referred to as western mountain mahogany.

Cercocarpus ledifolius is the larger of the two, eventually reaching 15 feet or more. Its green leaves can vary from ½ inch to slightly more than an inch long. Plants have a mostly upright form. Their general appearance is typical of western dryland trees and shrubs, that is, less densely foliated than eastern species. *Cercocarpus intricatus* is smaller, growing 4 to 6 feet tall. Its intricately branched, light gray twigs show effectively through its narrow leaves, which are about half the size of the other species.

Although broad-leaved evergreens, in general, are rather poorly adapted to horticulture in our region, they include some of the most dramatic and beloved plants in our landscapes. Many do surprisingly well when their locations are carefully chosen and our soils are adequately amended. Those broad-leaved evergreens native to our region, especially, deserve wider use in our landscapes. ❧

Ground Covers

James E. Klett

Ground covers that are evergreen provide desirable year-around color and texture. They are especially valuable in areas that are highly visible, such as near driveways, sidewalks and entryways.

Broad-leaved evergreen ground covers often have flattened, leathery leaves resembling those of deciduous plants. There are vining forms, low spreading types, and low clump-formers.

Where you plant broad-leaved evergreen ground covers is especially important in the Rocky Mountain and Plains states. These plants are susceptible to wind desiccation and normally should not be planted in direct winter sun or wind. Often they need to be protected in winter with temporary screens, mulches or anti-transpirants to help prevent the wind from drying their leaves.

The narrow-leaved evergreen ground covers have fine textured, scale-like or awl-shaped needle-like leaves which are generally a little less susceptible to the drying effects of winter sun and wind than the broad-leaved ones. This group includes the low-growing and spreading junipers that are very popular in this region.

Broad-Leaved Ground Covers

Bearberry, or kinnikinick, *Arctostaphylos uva-ursi,* is a creeping ground cover that grows approximately 6 inches to 1 foot tall and 2 feet or more across. Often the branches root as they spread. They grow fairly slowly after transplanting, but more rapidly once they are established. The leaves are small, between ½ to 1-½ inches long, glossy, dark green above and a lighter green beneath. They often turn reddish bronze in the fall. The clusters of white or pink urn-shaped flowers are borne in the spring and are followed in late summer by red fruits that often persist through the winter. Bearberry is salt tolerant, but it needs an acid, well-drained soil. It also grows best in a partially shaded site, but can tolerate some wind. Bearberry is often slow to become established after planting, but mulching helps.

Lowfast cotoneaster, *Cotoneaster dammeri* 'Lowfast', is another low-growing, mat-like ground cover. It reaches 12 to 18 inches in height. The 'Lowfast' cultivar is hardier than the species and has very dark, glossy, green foliage that is only semi evergreen in colder areas. Its white flowers open in May, on into June, and are followed by

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Panayoti Kelaidis

Ice plant, *Delosperma cooperi*, is a succulent evergreen ground cover.

scarlet fruits. This plant performs best in a protected area and would be ideal where there is prolonged snow cover to protect it from winter wind.

Purpleleaf wintercreeper, *Euonymus fortunei* 'Coloratus' is a very dense and vigorous trailing semi evergreen to evergreen ground cover that grows approximately 6 to 18 inches tall. As the stems creep along the ground they root wherever they touch the soil. It may also climb to over 20 feet by means of aerial rootlets. Wintercreeper is mildly invasive and has a rapid growth habit once established. When grown as a ground cover the plant does not produce any flowers or fruit.

During the summer the leaves are deep, glossy green but as the weather cools they turn dark red-purple on the upper side, lighter on the underside. If the plant is grown in an unprotected area it may lose some leaves in winter. The plant does well in most landscapes and can be used to stabilize slopes.

There are other cultivars of *Euonymus fortunei* that are sold along the Front Range. The variegated-leaved *Euonymus fortunei* are often planted but they seem to be a little less hardy than the green forms. One cultivar, 'Variegatus', available in both a trailing and climbing form, can grow 15 to 24 inches tall. The leaves are grayish-green with white margins. Other variegated cultivars that often get taller than 'Coloratus' are 'Emerald Gaiety', 'Emerald 'n Gold', and 'Silver Queen'.

English ivy, *Hedera helix,* is a low-growing, high climbing, evergreen ground cover that normally gets about 10 inches tall and spreads very rapidly, rooting as it goes. The plant also has the ability to climb by means of special "hold-fasts" along its stems. Both juvenile and mature growth forms may occur. In its juvenile stage the plant has a trailing, far-reaching, ground-covering growth habit and does not flower or fruit. The mature form occurs when the climber reaches approximately 15 feet and produces flowers and fruit. Leaves of the juvenile stage are lobed; those of the mature, flowering stage are unlobed. English ivy grows best in a rich, well-drained soil with fairly large amounts of organic matter. In our area it should be planted in shade and protected from winter sun and wind which dry and burn the leaves. English ivy is easy to establish after planting. Annual pruning is usually needed to keep it in bounds.

Creeping mahonia, *Mahonia repens*, is an evergreen that grows approximately 1 foot high and spreads by underground stems. The leaves, bluish-green on their upper surfaces, are pinnately compound with holly-like leaflets. The yellow flowers in April and May are followed by bluish-black berries from mid- to late summer. The plant grows best in moist, well-drained soils. A proper site is very important. Creeping mahonia must be protected from winter wind and sun. Survival by stock collected from the wild or handled bare-root is often poor, but container-grown plants survive transplanting well.

Common periwinkle, *Vinca minor,* is a trailing, mat-forming, evergreen ground cover that grows approximately 6 inches in height and spreads widely. The branches root as they creep. The dark, glossy green leaves are simple and generally less than an inch long. Its lilac-blue flowers peak in April and then appear sporadically until midsummer. Periwinkle does best in moist organic soil but cannot tolerate an extremely wet site. It usually covers well in relatively dry shade.

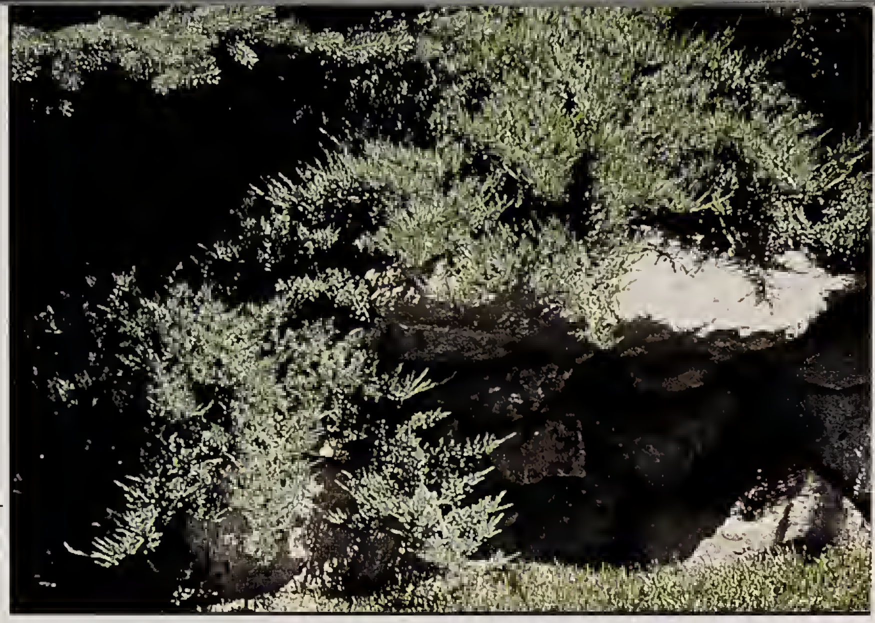
Narrow-leaved Ground Covers

The trailing Chinese juniper, *Juniperus chinensis* 'Procumbens', is a dense evergreen that grows to 2 feet in height and can-spread 10 to 12 feet. The leaves are all needle-like, with spiny tips, bluish to gray-green. Fruits rarely occur on cultivated plants. It tolerates most well-drained soils, from slightly acid to alkaline, and it grows best in full sun. The cultivar 'Nana' is an outstanding plant that grows to just 12 inches and spreads to 5 feet. The awl-shaped leaves, a little shorter and wider than that of the species, are also more densely arranged on the stem. The new foliage is bright green, becoming bluish-green during the summer, then purplish in winter.

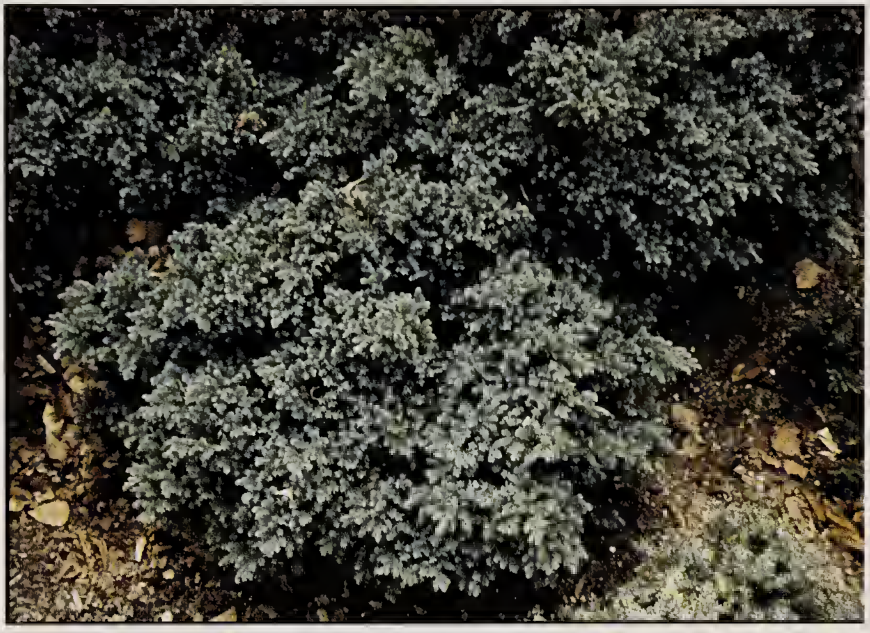
Creeping junipers, *Juniperus horizontalis,* are widely grown. Two good cultivars are 'Plumosa' and 'Wiltonii'. The Andorra creeping juniper, *J. h.* 'Plumosa', has a distinctive, flat-topped, spreading growth habit. It grows 18 to 24 inches high and 8 feet or more wide, with plume-like branches growing from the center in all directions. The needles are grayish-green, becoming purplish in winter. The plant is not as dense as some of the other cultivars of *J. horizontalis.*

The blue rug creeping juniper, also known as the blue Wilton, Wilton carpet and Wilton's creeping juniper, has a very dense, flat growth habit, reaches 6 to 8 inches high and spreads 6 to 8 feet. It is one of the lowest growing juniper cultivars. Branches often take root where they come in contact with moist soil. The leaves are very small and closely pressed to the stem, silver-blue in summer and grayish-blue to slightly purple in winter. The blue-gray color is enhanced by its abundant blue fruit. It is a very adaptable ground cover for the Rocky Mountain and Plains states.

The savin juniper, *Juniperus sabina*, is usually a stiffly upright plant not suitable as a ground cover. Certain cultivars of the species, however, are very useful. The Broadmoor savin juniper, *J. sabina* 'Broadmoor', is a ground cover that grows 12 to 24 inches and can spread to 10 feet. The horizontal branches have short upturned branchlets. As the plant matures it seems to mound higher in the center. The leaves are grayish-green. 'Buffalo' is a cultivar with very feathery branches and bright green foliage which retains its bright color even in winter. The plant matures about 12 inches high and 6 to 8 feet wide. Being female, it sets fruit. The plant is very hardy and adaptable to both partial shade and full sun.



Diane Ipsen



Diane Ipsen

Top, 'Broadmoor' juniper; above, 'Blue Star' juniper

Russian arborvitae, *Thuja orientalis,* is a beautiful evergreen ground cover, worth trying but not entirely proven in this region. It grows approximately 15 inches tall and spreads almost indefinitely. The leafy branchlets are arranged in flattened sprays like true arborvitae. Foliage is bright green in summer and turns bronzy purple to brown in winter. It is vigorous even in hot summers. (This plant is also listed by some as *T. microbiota* var. *decussata* but is more likely a juvenile form of *Thuja orientalis.*) ❧

Are You Confused ...

Diane Ipsen

...by some of the terms? When is a conifer not an evergreen? What is a conifer? Is it a pine?

Read on....

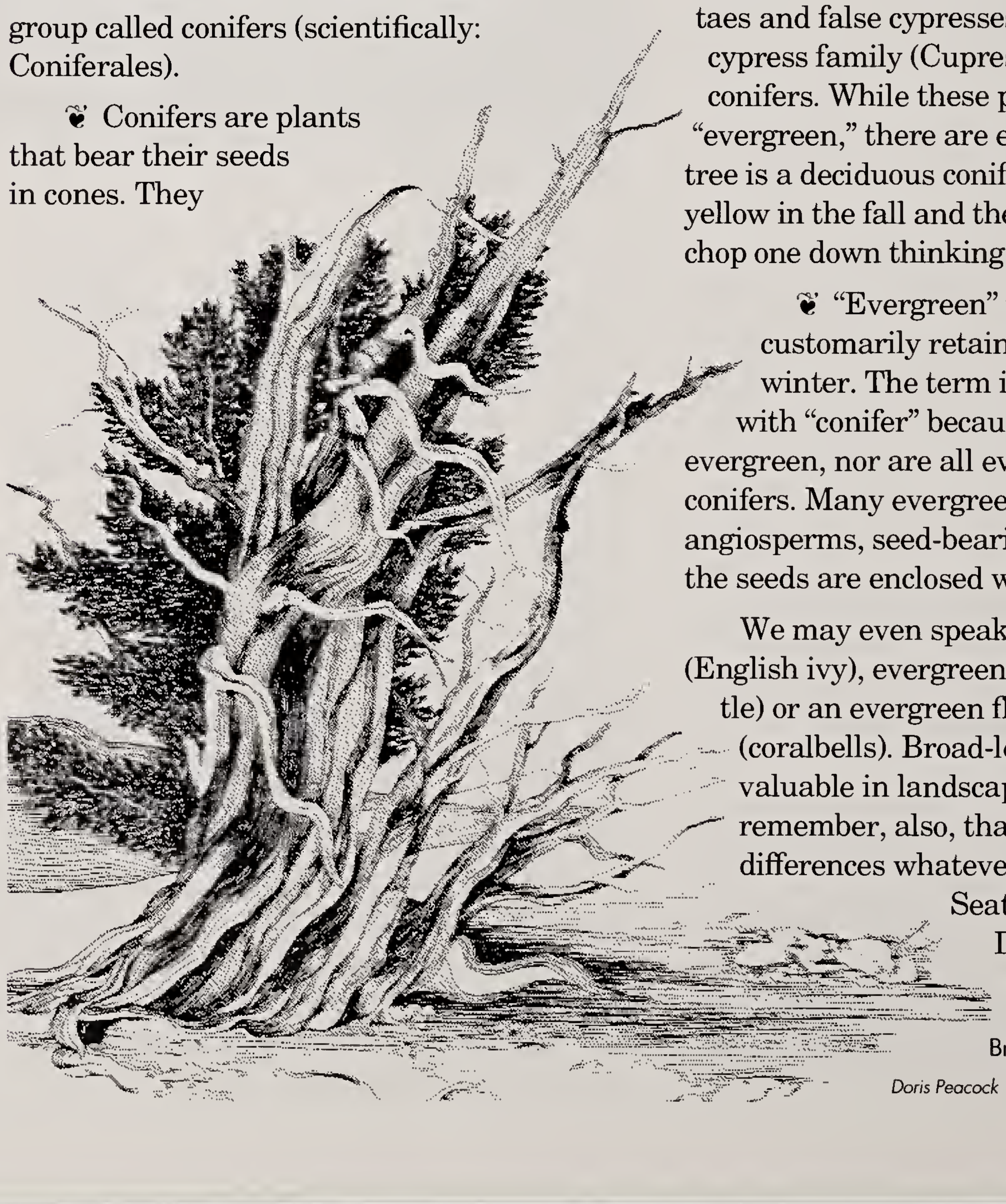
❦ Gymnosperms are seed-bearing plants in which the seeds are naked and free rather than encased in fruit. This includes the group called conifers (scientifically: Coniferales).

❦ Conifers are plants that bear their seeds in cones. They include the pine and cypress families. Though it may seem odd, juniper and yew "berries" are technically cones.

❦ The pine family (Pinaceae) includes spruces, pines, firs, larches, yews, cedars, hemlocks and Douglas-firs. Junipers, arborvitaes and false cypresses are members of the cypress family (Cupressaceae). All are conifers. While these plants are usually "evergreen," there are exceptions. The larch tree is a deciduous conifer; its needles turn yellow in the fall and then drop entirely. Don't chop one down thinking it's a dead spruce!

❦ "Evergreen" refers to plants which customarily retain their foliage over the winter. The term is not interchangeable with "conifer" because not all conifers are evergreen, nor are all ever-green plants conifers. Many evergreens are broad-leaved angiosperms, seed-bearing plants in which the seeds are enclosed within a fruit.

We may even speak of an evergreen vine (English ivy), evergreen ground cover (myrtle) or an evergreen flowering perennial (coralbells). Broad-leaved evergreens are valuable in landscape plantings. But remember, also, that because of climatic differences whatever is evergreen in, say, Seattle or Washington D.C. may not be evergreen in Colorado. ❧



Bristlecone pine tree

Doris Peacock

Insect Pests Associated with Conifers

Whitney Cranshaw

A large variety of insects, both native and introduced, are associated with conifers in Colorado. For the most part their activities cause little or no serious injury to the plants. However, damaging outbreaks can occur, particularly with species that have developed a local track record as a serious pest (for example, the pine needle scale, the spruce spider mite and the Douglas-fir tussock moth). Persons interested in landscape planting should be aware of these potential pests so that they can be managed, even avoided.

Scale Insects

In most landscape settings scale insects are the most damaging associated with evergreens. The major pest is the pine needle scale, *Chionaspis pinifoliae,* a small, white hard scale that feeds on the needles. In high populations pine needle scales cause needle yellowing and drop. Spruces and mugo pines are particularly susceptible to this species, although it may be found on any pine species.

Pine needle scales spend the winter as eggs under the cover of the mother scales. During mild winters some females may survive and lay eggs again in spring. Overwintered eggs hatch as early as late April or the first week of May and the newly emerged crawlers settle on nearby needles. This first generation becomes full grown in early summer and a second generation, which attacks the new needles, hatches in mid- to late July.

Pine needle scales have several natural enemies, notably small lady beetles which prey on the species. Also, extreme winter conditions can kill many of the overwintering eggs. These often act to provide adequate control. However, applied controls are sometimes necessary. Crawler sprays, which target the newly hatched insects, can be highly effective although they are somewhat tricky to time correctly. Several insecticides are available which can provide control of crawlers, e.g., Sevin, Talstar, Dursban, Tempo, Orthene. Horticultural oils also are highly effective for controlling crawlers or young, relatively unarmored nymphs, although these treatments will temporarily remove the bluish waxy bloom from spruces.

In recent years the pine tortoise scale, *Toumyella parvicornis,* has increased as a problem in some areas, notably parts of metropolitan Denver. This is a fairly large "soft scale" most commonly observed when the fertilized females on twigs swell in size during late spring. Unlike pine needle scales, pine tortoise scales also excrete large amounts of sticky honeydew.

Pine tortoise scales spend the winter as

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partially developed insects on the twigs. Eggs are produced in June, with crawlers emerging during late June and early July. The young scales first settle on the needles, later moving to the twigs at the end of summer. There is only one generation per year. Dormant applications of horticultural oils are probably the easiest control of the species. Insecticide treatments directed at newly emerged crawlers or early summer oil sprays should also provide protection.

An infrequent, but sometimes damaging species associated with native pinyon pine is the pinyon needle scale, *Matsococcus acalyptus.* This scale spends the winter on trunks and large branches. It becomes active very early in the season, as overwintered females produce conspicuous cottony egg sacks in early April. During the growing season the developing scales feed on the needles, occurring as "bean stage" nymphs on the needles by summer. If control is necessary the overwintered females on the lower part of the tree in early spring are most effectively targeted.

Scattered problems with the juniper scale, *Carulaspis juniperi,* also occur in the state, primarily in the Boulder area. This is a hard scale, most commonly associated with upright junipers.

Spruce Spider Mite

The spruce spider mite, *Oligonychus ununguis,* can be extremely destructive to spruces and junipers. Outbreaks are frequent, encouraged by our arid climate. Problems can also be exacerbated by use of certain non-selective pesticides, such as carbaryl, that are highly destructive to their natural enemies. Spruce spider mites damage the plant by rasping the needle surface and sucking the plant sap. Heavily infested plants have an unthrifty, grayish appearance and often lose needles.

The spruce spider mite spends the winter in the egg stage on its host plant. Eggs hatch in early spring and the mites develop rapidly, typically with generations at intervals of two to three weeks. Some webbing is produced by these mites, although not as much as by the two-spotted spider mite, the common species found in gardens and greenhouses.

Increasing the humidity around a planting can retard the development of spruce spider mite problems, and regularly spraying susceptible plants with a jet of water may be feasible in small plantings for mechanical control. Relatively few pesticides are effective against this mite, including Vendex, Dursban or Kelthane, although insecticidal soaps have been successfully used in some research.

Borers

Two species of related caterpillars have emerged as the most serious trunk- and branch-boring insect pests associated with pines in Colorado. Pinyon (and rarely ponderosa) pines can be attacked by the pinyon pitch mass borer, *Dioryctria ponderosae.* The young caterpillars make deep gouging wounds in the bark and cambium, resulting in copious amounts of sticky pitch at the wound. Attacks are often concentrated at branch crotches and near previous wounds. This results in structural weakening of the tree and serious dieback.

The pinyon pitch mass borer apparently has a life cycle that may extend beyond one year. Most emerge as adult moths during late June and July; they fly and lay eggs throughout the summer. Once the eggs hatch and the larvae enter the bark they are very difficult to control with insecticides. Repeated applications of Mavrik or Dursban during the egg laying period have provided only about 50 per cent control. Individual larvae in pitch masses can be dug out or killed by inserting moth crystals into the wound site. Since susceptibility appears to be associated with succulent growth and bark cracking, pinyon pines should not be planted where they will be over-watered.

Recently the Zimmerman pine moth, *Dioryctria zimmermani,* has become a problem on Austrian and Scots pines, spreading from some original infestations in the southern Denver area. Larvae of this insect also concentrate their attacks at crotches, making the trees susceptible to branch-breaking during heavy wind storms or snows. Wounds are

Mass of pitch oozing from holes of pinyon pitch mass borer

Whitney Cranshaw

Pitch flowing from damage by mountain pine beetle

Whitney Cranshaw

Larva of tip moth on pinyon pine

also characterized by light-colored popcorn-like sap flowing from the injury.

Zimmerman pine moths have a one-year life cycle. Adults emerge in late June and July and lay eggs in midsummer. Newly hatched larvae do not immediately tunnel into the tree, but feed externally on the bark for a while and spend the winter in bark cracks. They continue to feed on the bark in spring until they enter the tree to finish their development. Preventive insecticidal sprays can be applied in either August or early May, the latter timing reportedly more effective in the Midwest.

Both Zimmerman pine moth and pinyon pitch mass borers appear to be fairly “aggressive” species, capable of attacking healthy trees. Other borers associated with conifers limit their attacks to recently dead or dying wood, sometimes attacking pines under severe transplant stress. Perhaps the most conspicuous of these are the pine sawyers, large (¾-1 inch) gray beetles with very long antennae. Commonly, the adults emerge from pine logs and may sometimes be seen feeding on twigs during midsummer. One additional species, *Atimia huachucae*, is of occasional concern on junipers. Scattered outbreaks of this borer occur in older junipers throughout the state, sometimes causing dieback.

Tip Moths and the White Pine Weevil

Tip moths are insects which, in the caterpillar stage, tunnel under the bark of the terminal growth and produce dieback symptoms. In Colorado pines are attacked by either of two groups of tip moths. Most pines are hosts of *Rhyacionia* species, primarily the southwestern pine tip moth, *R. neomexicana.* Pinyon pines are attacked by their own complex of insects. Damage by all tip moths is quite conspicuous but does not cause serious, long-term injury unless a high percentage of the terminals are regularly killed.

Southwestern pine tip moths spend the winter as pupae protected within cocoons around the bases of previously infested trees. The adult moths emerge and fly in mid-spring. However, they are most attracted to pines when the new needles start to form in spring, the candle stage of pine growth. They lay their eggs at this time. The young larvae then enter the developing shoots. Tip dieback becomes obvious on the pines about one and a half months later, as the full-grown caterpillars girdle the shoot.

Two types of tip moths commonly attack pinyons. The pinyon tip moth, *Dioryctria albovitella*, is the most common species; it enters the pinyon branch tips in late May and June. The pitch nodule maker, *Petrova arizonensis,* also damages tips but its presence is characterized by a large purple or pink nodule of pitch. Both species emerge as adult moths in midsummer. However, the pitch nodule makers immediately enter the tips after hatching, while the pinyon tip moths remain on the outside until the following spring.

Tip moths are best controlled with insecticides when the eggs are laid or when the

Whitney Cranshaw

Galls of spruce gall adelgid on Colorado spruce

Whitney Cranshaw

Adult spindle gall midge on pinyon, and its gall

The frothy defense of spittlebug is suspiciously unattractive, but harmless.

larvae are still present on the external bark, before they tunnel. This occurs during early candling stage by the southwestern pine tip moth, during late July and early August by the pitch nodule moth and in either August or early May by the pinyon tip moth. In Colorado State University trials, insecticides with systemic activity (Orthene, Cygon) have given the best control of these insects.

Another type of terminal injury is produced on spruce trees by the white pine weevil, *Pissodes strobi.* This insect develops to the larval (grub) stage under the bark of the main leader, causing it to die back in the form of a shepherd's crook during late spring. This type of injury can seriously affect the form of a tree, as competing side shoots will then form multiple leaders, resulting in the tree developing a bushy profile. If damage has occurred, the form can be salvaged by purposely retraining one of the surviving side leaders to become the dominant terminal. Damage, however, is primarily limited to higher elevations in the state.

The adult weevils spend the winter under cover of debris. They move into the trees very early in the season, usually April, chew small pits in the terminal buds and lay eggs. The developing larvae feed under the bark, ultimately girdling their tree. They then form distinctive "chip cocoons" under the bark. Later they emerge through small holes. Preventing damage involves treatment with insecticides timed to kill the adult weevils returning to the trees in early spring. Dursban and Sevin should be effective for this purpose.

Gall-making insects

A few of the insects associated with conifers make distinctive distortions, called galls, in developing new growth. These galls are often quite conspicuous because of their peculiarity and they tend to raise concern. However, rarely are large areas of the trees involved by this injury.

Perhaps the best known gall-maker is the Cooley spruce gall adelgid, *Adelges cooleyi.* This insect produces a prominent cone-like gall on the tips of blue spruces. Galling is concentrated on the protected sides of the trees (usually on the north and east). Some individual trees seem particularly prone to infestation.

The Cooley spruce gall adelgid has a rather unusual life cycle, involving two host trees, spruces and Douglas-firs. Infestations start on the spruces by wingless females, which spend the winter on the undersides of twigs. In spring they resume growth and produce a large egg sack. Eggs hatch when the new spruce needles emerge and the small nymphs settle at the bases of the developing needles. Feeding by the insects at this time causes the shoots to thicken and form a series of chambers, in which the Cooley spruce gall adelgids grow.

By late June or July the galls dry and open, appearing to be "cones." The insects then emerge, transform into a winged stage and leave their trees. Their normal migration is to Douglas-firs, the alternate hosts. However, it seems likely that some are able to repeat

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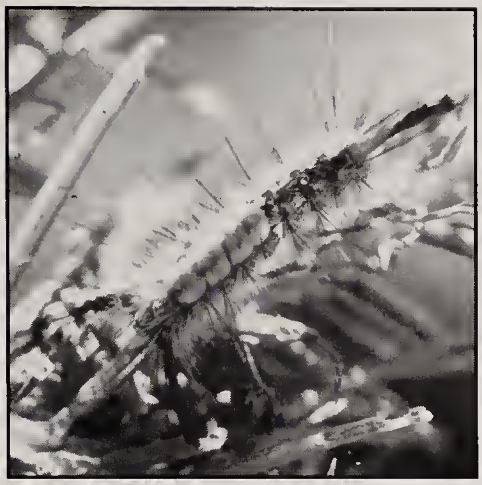
James Feucht

Tussock moth damage on small spruce


Whitney Cranshaw

Mature larva of Douglas-fir tussock moth

Whitney Cranshaw

Giant juniper aphids on pine

the cycle on spruces. Regardless, new, winged Cooley spruce gall adelgids return to spruces in late summer to produce an overwintering form.

Cooley spruce gall adelgids succumb to many natural forces. The overwintering females are very susceptible to late spring frosts that occur after they have emerged from their winter dormancy. Blowing winds and brushing needles dislodge others, particularly on more waxy-needled (that is, blue) trees. Several insecticides can also control them; treatments are best applied in mid- to late April before they form their large egg sacks.

Gall midges distort the developing needles of certain pines, producing swollen pockets along the base of the needle in which the developing midge larvae live. Stunt midges, *Contarinia coloradensis,* or *Janetiella* sp., associated, respectively, with ponderosa and pinyon pines, cause the needles to be greatly shortened. Needles attacked by the pinyon spindle gall midge, *Pinyonia edulicolia*, are normal length. However, all needles damaged by gall midges die prematurely, within a year.

Serious infestations resulting in significant defoliation by gall-forming insects are rare. In most instances natural enemies attack the young midges in the gall and provide adequate biological control. If chemical controls are considered, they should be applied during the period when new needles are emerging and galls are forming. Only the insecticide dimethoate (Cygon) has been consistently effective against gall midges on pines.

Defoliators

Several insects chew on the needles of coniferous evergreens, occasionally causing severe defoliation. Most important is the Douglas-fir tussock moth, *Hemerocampa pseudotsugata,* a serious pest of spruces, firs, and Douglas-firs in several Front Range communities, notably Denver and Colorado Springs.

These Douglas-fir tussock moths spend the winter as eggs in masses covered with the body hairs of their mothers. Egg masses are commonly on twigs and trunks, but may be in the vicinity of the previously infested tree. Human movement of the egg masses may be an important factor in spread of the insect.

The eggs hatch in spring, typically late May and early June. The larvae prefer to feed on the tender, developing needles. As the needles are chewed, infested trees take on a brownish cast, typically concentrated in the upper parts. During large outbreaks older needles also will be destroyed, seriously stressing the tree. Dieback from the top is the most typical symptom resulting from a severe infestation.

Feeding is often finished by late June or early July, although it can continue into midsummer in some locations. The caterpillars pupate in a cocoon on or around the infested tree, and adults later emerge in 10 to 14 days. Female moths are wingless and lay eggs near the point where they pupated.

In the forested areas of Colorado, budworms are the most serious defoliators. This includes the western spruce budworms, *Choristoneura occidentalis,* on Douglas-firs and spruces, and pine budworm, *Choristoneura C. lambertiana,* on lodgepole and ponderosa pines. Both of these species occur periodically in massive outbreaks, causing extensive defoliation which can kill trees or weaken them so that they are susceptible to later bark beetle attack.

Other caterpillars that invade Colorado conifers are the larvae of the pine butterfly and of the tiger moth. In addition, early season injury, before new growth emerges, is sometimes sustained due to sawflies.
Most caterpillars are susceptible to *Bacillus thuringeinsis* products (e.g., Dipel, Thuricide, Biobit), although control of Douglas-fir tussock moth caterpillars with these materials has often not been satisfactory. Sawflies are not susceptible to *B. thuringiensis.* Carbaryl (Sevin), Dursban, Orthene, Tempo, Mavrik, and Talstar are also quite effective against both caterpillars and sawflies.

Aphids

Several types of aphids can be found on needled evergreens, although they rarely cause much injury. Among them are the giant conifer aphids, *Cinara* species, which are quite large brown or black aphids that superficially resemble ticks. These can be found on spruces, pines and junipers. Woolly aphids, *Pineus* species, produce waxy threads which cover their bodies; they are sometimes common in spring on pines. In addition, the alternate stage of the Cooley spruce gall adelgid occurs as a woolly aphid on Douglas-fir trees.

Aphids associated with conifers spend the winter as eggs on the old needles. Largest populations are typically found in spring, and the woolly aphids leave the pines by late spring to feed on summer host plants. Controls are almost never warranted for plant protection. Minor needle bending can occur on Douglas-firs due to the Cooley spruce gall adelgid and occasional needle shed on junipers and spruces results from outbreaks of giant conifer aphids.

Bark Beetles

As their name implies, bark beetles develop by feeding on the cambium layer under the bark. Often this activity is aided by the concurrent presence of blue stain fungi, *Ceratocystis* species, which helps to kill the plant and thus provide the dying wood on which the bark beetles thrive. This is a mutualistic relationship; the bark beetles are the main carrier of this fungus to new trees.

Many different genera of bark beetles occur. Most infamous are members of the genus *Dendroctonus,* including the mountain pine beetle, *D. ponderosae,* and the Douglas-fir beetle, *D. pseudotsugae.* Both these species occur in mountainous areas, particularly following stressful events, such as budworm defoliation. Trees killed by these beetles “fade” rapidly, turning reddish-brown, then dying within a year after they have been successfully attacked.

In landscape settings, the engraver or ips beetles, *Ips* species, predominate. These are less aggressive pests, rarely attacking trees in good health. However, newly transplanted trees or trees that have suffered root injury are at high risk and can support large populations of these beetles, which can then threaten other nearby conifers.

Fundamental to controlling bark beetles, including *Dendroctonus* species, is maintaining and promoting vigor in your plants. Vigorously growing trees have natural defenses that usually can ward off attacking beetles. Sanitation, removing infested trees and dead wood before beetles emerge, is also part of a good management program.

Individual trees can be protected from attack by appropriately timed insecticide sprays to kill the adult beetles when they first visit a tree. Dursban, Lindane, and Sevin are standard insecticides for this. These sprays can be easily timed for species such as mountain pine beetles and Douglas-fir beetles which each have one generation per year. However, ips beetles typically have multiple, often overlapping, generations so control measures need to be continued over a longer period when high risk exists. ❧

Dwarf Conifers for Rocky Mountain Gardeners

Kelly D. Grummons

Tromping through the crusty snow looking for the perfect Christmas tree was always a delight for me as a child. Usually, the old juniper that we selected didn't look so perfect when we got it home—kind of amber brown with empty spots that required branches to be wired into them. Of course, the tree was always bigger than we had figured.

It was on these outings that I first noticed the miniature "trees" growing right out from a branch of a normal tree. The witches' brooms were little dense duplicates of the original pine or juniper caused by some mutation, perhaps genetic or pathogenic. More than one of these little trees through the years came home to be my own special Christmas tree, sitting on our pine toy box.

It wasn't until I worked at Brooklyn Botanic Gardens that I learned from a friend about how pieces of these brooms are grafted onto a normal seedling stock to create dwarf conifers. Other dwarf conifer selections are found as seedlings with a genetic dwarfness not caused by a mutation on a normal tree.

Iseli Nursery in Oregon is responsible for most of the commercial dwarf conifer production in the United States. I understand, also, that some local enthusiasts are active in finding potentially valuable clones from nature here in our region.

A dwarf blue clone of Colorado spruce that is very dear to me is *Picea pungens* var. *glauca* 'R. H. Montgomery'. It is a powder-blue, pyramidal little fellow that grows slowly, eventually reaching 5 to 8 feet high and wide. Under dry culture, the plant grows 2 to 3 inches per season. Under moist, shadier conditions, I've seen it progress at 4 to 6 inches per year. What a handsome plant it would be as a specimen in a confined city garden where a normal-sized spruce wouldn't fit! Imagine it underplanted with dwarf wintercreeper, *Euonymus fortunei* 'Kewensis', and spring heather, *Erica carnea.*

A favorite "bird nest spruce" for this area is *Picea abies* 'Pumila'. It isn't quite as nest-forming as *P. a.* 'Nidiformis', but it forms a rather nice globe that sometimes forms a leader, which gives it a teardrop shape. Unlike many other Norway spruce selections this one will stand full sun, even at our high elevation, providing that enough moisture is constantly available. Its bright color and dense habit make it valuable for a rock garden or a low hedge. The little red flowers of dwarf twinbeard, *Diascia* 'RubyFields', look very cheerful in front of this dwarf tree.

If you've been looking for a truly dwarf mugo pine, consider *Pinus mugo* 'Iseli's White Bud'. It has dense, very short, dark green needles and resinous white buds in winter and early spring. At 2-½ feet high and

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Kelly D. Grummons, the head grower at Paulino Gardens in Denver, received his B.S. in horticulture at Colorado State University and was an intern at Brooklyn Botanic Gardens. He grew up in the Black Hills of Wyoming. Native prairie plants are his passion.

3 to 5 feet wide, this jewel is one of the best selections ever to be introduced. Plant it in full sun for optimum dwarfness and grow it comparatively dry.

One of the first dwarf trees used in our landscapes was the Alberta spruce, *Picea glauca* 'Conica'. Its narrow, pyramidal shape and bright green color make it very desirable in formal gardens. Also available is *Picea glauca* 'Saunder's Blue', with the same habit as 'Conica' but with a steel-blue color. Grow it in partial shade to discourage its reversion to green, and cut out any green branchlets that develop. Perhaps with further selection this reversionary trait will be eliminated. These dwarf varieties get 7 to 10 feet high and 6 to 7 feet wide after many decades.

Unlike its lacy, 80-foot-tall counterpart—the eastern white pine—the dwarf, blue *Pinus strobus* 'Blue Shag' is diminutive. Its long, soft needles are deep blue-green with nearly white striations. What a gem! Its 3- to 5-foot informal, sometimes leaning stature can be highlighted by planting it near a compact, silver snow-in-summer, *Cerastium tomentosum,* or royal blue *Veronica prostrata.* Either sun or shade suit this clone but it needs plenty of moisture.

Dwarf Serbian spruce, *Picea omorika* 'Nana', is gaining popularity here as a tough plant in conifer collections. It is broadly pyramidal with a strong leader. The waxy green branchlets are bluish-silver beneath. For best appearance you should avoid growing it under dry conditions. Its 4- to 6-foot height is ideal for many situations. In a shady garden dwarf blue hostas and Bethlehem sage, *Pulmonaria* 'Roy Davidson', are useful companions to this plant.

If you need an upright dwarf conifer for a special effect, try a dwarf Swiss stone pine, *Pinus cembra* 'Nana'. This is considered very choice. Its soft green needles shimmer with a touch of silver. It thrives in sun or shade and likes moderate moisture. The plush gray-green of *Veronica pectinata,* with sky-blue flowers and evergreen mossy foliage, make it one of my favorite ground covers to use with this tree. You could add clumps of dwarf wild yellow tulips, *Tulipa tarda,* for an super combination.

One of the few junipers small enough to welcome into a rock garden is *Juniperus squamata* 'Blue Star'. It has crisp blue foliage and a pudgy, rounded shape. It tolerates full sun but finds its glory in shade or partial shade. I have it planted in my parents' rock garden with a big clump of hen-and-chicks, *Sempervivum ciliosum* 'Borisii', and woolly thyme—in shade!

Picea pungens 'Saint Mary's Broom', a very slow growing, globose blue spruce, thrives in sun or shade. At about 2 inches of growth per year, this one won't outgrow even the smallest garden. I have mine planted with *Veronica spicata* 'Red Fox' and hardy ice plant, *Delosperma nubigenum.*

The real pearl in my garden, though, is a micro-miniature mugo pine called *Pinus mugo* 'Mitsch Mini'. It was planted from a 2-½ inch pot into a shallow depression in a moss rock five years ago and is now only the size of a baseball! I think that its companion *Sempervivum* 'Cebenese' shelters its roots from heat and cold and helps to absorb excess moisture during rainy spells.

Dwarf conifers have a place in almost every garden. Try them; you won't be disappointed. ❧

There are dwarf forms of almost any conifer you can imagine. Mr. Grummons also recommends these tried-and-true selections:

White spruce	*Picea glauca* 'Echinoformis'
Black pine	*Pinus nigra* 'Hornibrookiana'
Scots pine	*Pinus sylvestris* 'Beuvronensis'
Balsam fir	*Abies balsamea* 'Nana'
Colorado spruce	*Picea pungens* 'Mrs. Cessarini'
Norway spruce	*Picea abies* 'Clansbrassiliana'
Norway spruce	*Picea abies* 'Elegans'
White spruce	*Picea glauca* 'Pixie'

Pines and Spruces for Colorado Landscapes

Jim O'Shea

Pines and spruces are, with some exceptions, among the largest, stateliest evergreens available for our landscapes. Among deciduous trees and other evergreens they provide stability and are useful as backgrounds for structures and other plants. Their forms, however, differ, as do their cultural requirements.

Pines show great diversity in growth habit. Their needles are bundled in groups of two to five and are an identifying characteristic. They also contribute to the texture and appearance of individual species.

Pines are generally tolerant of exposed and relatively "poor" growing sites. However, over-watering or poor drainage, particularly in heavy clay soils, may lead to oxygen starvation (root suffocation). They are intolerant of shade, performing best in full sunlight and with sufficient space to allow them to develop fully—some species grow over 40 feet across.

Features that allow them to survive hot, dry sites, high winds, frozen soil and extremely low temperatures include a thick cuticle (wax on the needles), a hypodermis consisting of a layer or two of thick-walled cells below the epidermis and recessed stomates. All these reduce water loss from the plant.

Spruces, on the other hand, are more adaptive to moist, organically rich soils. They can tolerate some shade and are less resistant to drought than most pines.

Resin canals in the needles and throughout other parts of pines and spruces secrete resin. This is aromatic and antiseptic; it prevents the development of fungi and discourages some insect pests. Note: It is natural for the oldest (innermost) needles on all the pines we grow to yellow and drop each autumn.

How to Plant Pines and Spruces

Move and plant either pines or spruces as balled and burlapped (B&B) or containerized plants. Only small seedlings can be transplanted bare root. Trees should be planted in holes that allow 6 to 12 inches all around the ball for fill soil. To improve aeration, amend the fill soil with up to one-third organic matter. I prefer to wait until the tree is rooted out before fertilizing.

The proper planting depth varies somewhat with the soil texture. In sandy soils place the top of the ball at grade level and in clay soils 1 to 2 inches above grade. In clay the root ball should rest on firm soil at the bottom of the hole rather than the fill, otherwise the plant may settle too deeply. Immediately after planting a tree water it well, then allow the soil to get slightly dry before the next thorough watering, particularly for pines. Do not add small amounts of water on

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Jim O'Shea is horticulture instructor at Front Range Community College, where he teaches plant identification, plant science and garden management. For seven years he was a grower in Ohio and Kansas.

a frequent basis, as this promotes shallow roots. When checking soil moisture, dig down into the soil several inches to get a sample. Close your hand in a fist around some soil and if it remains in a ball after opening your hand, hold off watering until the soil sample you get is slightly crumbly.

When you test the fill soil for moisture also check to see whether the root ball is moist or dry. It is possible for the fill soil to be moist while the ball is dry, particularly if the ball was on the dry side when you planted it. Containerized plants should be watered and allowed to drain prior to planting. For B&B stock it is important to prevent the ball from drying out, and the tree becoming stressed, prior to planting.

It is best to plant pines and spruces spring through summer, even into early fall. While fall-dug and fall-planted material can sometimes succeed, there appears to be a greater chance of loss, due to little time for root regeneration before winter.

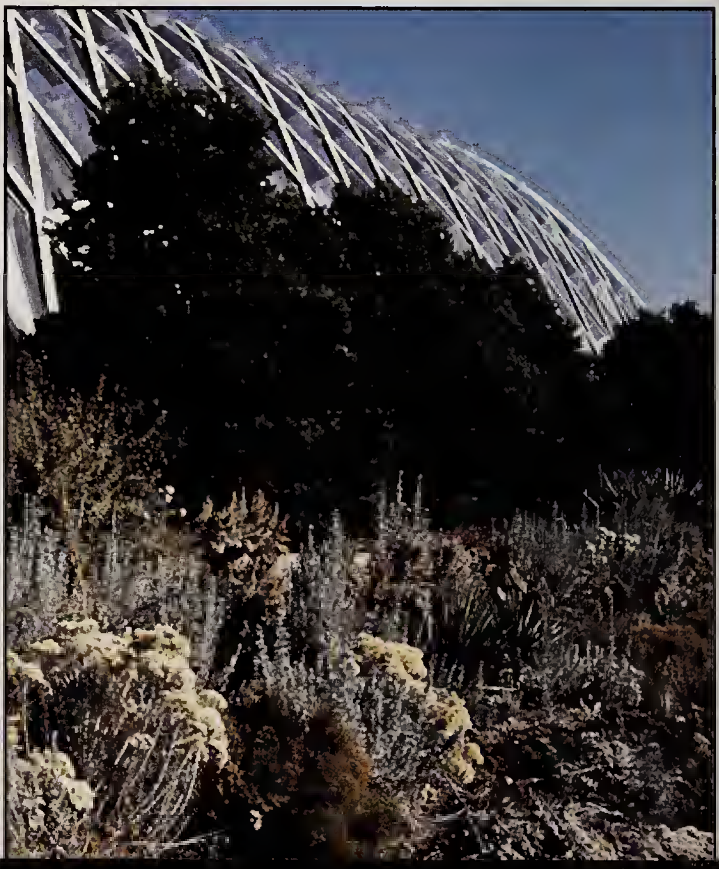
Finally, many nursery-grown evergreens have been sheared and have a compact form. This allows little opportunity for wind to pass through the plant. Therefore, you should stake tall specimens after you've planted them. Use 2-inch to 3-inch-wide grommeted canvas plant straps around the trunk. Thread wire or strong twine through the grommets and secure it to stakes in the ground. Flag the wire or cover it with white plastic so it is visible and people won't trip on it. Allow a little play in the wire and inspect it periodically. Wires and stakes should be removed after one to two years.

Selected Pines

Bristlecone pine, *Pinus aristata,* is a valuable native tree, tolerant of dry, rocky soils, whether alkaline or acid. Its mature size varies from 8 to 20 feet in height, with an irregular spread. It is extremely slow growing; use it as an accent plant. Its leaves are dark green with white resinous exudations. This species is among the oldest living plants on earth. A tree in eastern Nevada has been documented to be 4,900 years old. Foxtail pine, *P. balfouriana,* is related but does not develop the resinous exudations.

Limber pine, *P. flexilis,* is another native. Its young stems can actually be tied in knots, thus the name. Its mature size varies from 30 to 50 feet in height and 15 to 35 feet in spread. Conical in its youth, it matures as a broad, flat-topped tree. Its needles are often an attractive blue-green, especially in young plants. In short, the limber pine is a handsome tree, adaptable to fast-draining soils and a good choice for a large yard. Several cultivars are available in the trade.

Andrew Pierce



Above, young pine tips in early spring
Right, native pinyons and artemisias on a south-facing slope near DBG's Boettcher Memorial Conservatory

Diane Ipsen

Blue (left), white (front) and Black Hills (back) spruces

Mugo pine, *P. mugo,* is thought of, usually erroneously, as a low, broad-spreading, bushy plant suitable for foundation plantings, borders, and groupings. However, most are seed-grown and they vary greatly in size and growth habit. This species includes a number of varieties or geographical forms, some of which can grow 20 to 25 feet tall, or taller. All tolerate transplanting and adapt to calcareous (high calcium) soils. If you are seeking a compact spreader select a plant with small growth increments between nodes. Although a number of "dwarf" cultivars are listed by nurseries, they are almost impossible to distinguish.

Austrian pine, *P. nigra,* is a tree 50 to 60 feet in height with a 20- to 40-foot spread. Conical as a young tree, it becomes large, broad, flat-topped and spreading. It's a hardy pine that withstands city conditions and tolerates heat, some dryness and clay and alkaline soils. Excellent for screen or windbreak, it is a superior tree—but only if it has room to develop.

Pinyon pine, *P. edulis,* is a small, bushy, native tree, slowly growing to 20 feet high, tolerant of dry situations once it is established. Its squat, resinous cones contain edible seeds. Valuable in ornamental plantings, its popularity has led to some overuse. As a consequence, several natural pests, including pinyon needle gall midge, aphids and pinyon pitch mass borer are becoming increasingly common, especially on stressed plants. This tree is subject to oxygen starvation and it is recommended that it not be planted at the corner of a building where the downspout can empty on the tree's roots, or in any poorly drained location.

The eastern white pine, *P. strobus,* is a fine-textured, graceful, fast-growing pine which can easily grow 2 feet (or more) per year after it is established, becoming 50 to 75 feet tall with a spread of 15 to 20 feet. The tree adapts to transplanting readily but may become chlorotic in soils with high pH. Its needles are usually light blue-green and attractive all year around, but some forms turn yellowish in winter. A columnar form is available.

Ponderosa pine, *P. ponderosa,* is a native useful in areas up to 7,500 to 8,000 feet elevation. Its needles vary from medium green to yellowish green. Resistant to drought and tolerant of alkaline soils, it is a useful forest and shelter belt tree that can grow over 75 feet in height and 50 feet in spread. Perhaps it is best left in its native habitat; it's not generally recommended otherwise.

The Scot's, or Scotch, pine, *P. sylvestris,* has needles that are variable in length and often attractively twisted. While popular and widely used as a Christmas tree, it is often passed by in the nursery, which is unfortunate. As this tree matures it becomes open and somewhat irregular in spread, creating a picturesque, Oriental effect. The orange-brown bark is also interesting. Scot's pines will grow in a variety of soils, including poor and relatively dry sites. As with all pines, though, good drainage is a must. Average landscape height is 30 to 50 feet with a spread of 25 to 35 feet. Various color forms exist; some are bluish green while others are yellowish, particularly during the winter. A fastigiate (narrowly upright) form is available.

Recommended Spruces

Spruce trees are usually tall, symmetrical, and formal in appearance. Its genus *Picea* includes nearly 40 species. (*Pix,* the Latin word for pitch, is the origin of the generic name.) The needles are usually four-angled, attached singularly to the stem, and borne on a short peg-like stalk.

Like the pines, spruces should also be moved balled and burlapped. They are shallow-rooted and prefer a more moist soil than pines. I have seen spruce roots growing along the soil surface when in compacted clay soil or when their roots are covered with black plastic.

Because of their strong vertical lines and large size, careful consideration must be given to site selection. Many landscape architects warn against placing these trees toward the front of the property or too close to houses or walkways because they consume the property or grow to block access.

White spruce, *Picea glauca,* has glaucous or pale green needles and grows 30 to 40 feet in height and 10 to 15 feet in spread. Pyramidal in habit as a young tree, it becomes tall, narrow and compact as an older tree. Dwarf Alberta spruce, *P. glauca* 'Conica', is a common dwarf conifer and grows only a couple of inches per year. *P. glauca* 'Densata', the Black Hills spruce, is a slow-growing tree much denser and sometimes preferred over the species.

Serbian spruce, *P. omorika*, is less well known and generally not as readily available as some of the other spruce species. However, it is a graceful tree, recommended because of its excellent foliage, narrow pyramidal shape and adaptability.

The Oriental spruce, *P. orientalis*, is distinctive for its very short needles, which are bright, dark green. Its graceful, attractive growth habit makes it a superior choice.

Finally, a few words about the most popular spruce tree of all, the Colorado spruce, *Picea pungens.* It is also called the Colorado "blue" spruce, but, surprisingly, it is often not blue. Since most trees are propagated by seed, genetic variability accounts for colors ranging from dull green to green to blue-green to silvery blue. Most frequently the seedlings with the finest blue or silver coloration are selected. Because there is a greater demand for these trees, they command a higher price in the nursery. Some of the bluer types are propagated and perpetuated by grafting; selected cultivars such as 'Hoopsii', 'Moerheim', and 'Thompson' are available. Fortunately, the color of a young tree is the color it will retain throughout its life. You can choose a young, relatively inexpensive tree with confidence.

When selecting pines or spruces for your landscape, recognize that many may become large trees. Some trees can overpower a small site and interfere with walks, access and overhead power and cable lines. Over time they can also restrict air movement, give unwanted shade in winter and crowd structures and other plants. Choose carefully, especially for a small property. ❧

Growing Evergreens in Containers

Ken Slump

As any nurseryman can tell you, growing and maintaining plants in containers poses a number of special problems and considerations. Nevertheless, in many situations this may be the best, if not the only, solution for creating a "living landscape." Some sites need the interesting texture, form and year-round attractiveness that only evergreen plants can provide, yet growing them in containers is the only solution.

Successfully growing evergreens in containers requires that you first accept realistic possibilities. It will require extra effort on your part. Most of the plant's environmental needs will be wholly under your control. Also, it is unrealistic to expect a woody evergreen plant to thrive indefinitely in a container of limited size. You will be less disappointed, too, if you opt to merely maintain the plants—don't expect rapid, lush growth from them. Here are some observations from my experience growing a variety of evergreens in a sheltered patio situation.

Containers

Your first consideration is the container. There are numerous choices available, including clay, glazed ceramic, wood, or plastic. Whichever you prefer, it must have drainage, that is, holes to let excess water escape. Glazed ceramic and plastic containers retain moisture well but lack the "breathability" of clay pots and wooden containers. Some clay pots tend to absorb too much moisture so they crack in freezing weather. My best success has been with large wooden containers. They resist heat buildup, they have good drainage and they provide winter insulation. The wood, of course, should be decay-resistant such as redwood or teak. In most cases, the bigger the container, the better.

Soils

Blending the right soil mix for a container plant can be tricky. The mix should suit the container and its location. For example, a light, rapidly draining soil mix is important in plastic containers since they tend to retain moisture longer than clay containers. The container's size and site, as well as the species of evergreen, will also determine the soil you use. In most cases your goal is a soil with good moisture holding capacity as well as good drainage. Add peat moss or other organic matter to your potting mix for increased moisture retention and sand or perlite for faster drainage. Ideally, you will not have to water more frequently than once or twice a week in the hottest weather. You should fertilize container plants judiciously and sparingly. Any fertilizer designed for

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Ken Slump is a horticulturist who undertakes special projects in the plant collections department at Denver Botanic Gardens. Evergreens and other plants grown in containers enliven the small spaces around his Denver townhouse residence.

trees and shrubs is satisfactory for evergreens. Remember, your goal is not rapid growth, as your plants will soon outgrow their containers. If possible, select a plant of the size, growth habit and effect you want, then simply strive to maintain it.

Repotting

Eventually, though, even the best managed plant will outgrow its container. When the plant's decline signals that it has exhausted the resources in its container you should either move the plant into the landscape, repot it into a larger container or remove it, root prune it and repot it back into the same container.

To rejuvenate a declining specimen, root prune it during its dormant season. Carefully dig the plant out of its container. You will likely find a thick, circling mass of roots lining the container. With pruning shears or a sharp knife carefully cut away at the tangled root mass until you can re-place the plant into its old container with a layer of fresh soil around the root ball. This is also a good time to prune the top part of the plant. (Essentially, this is the technique used to create artful bonsai specimens.) Following repotting, water your plant thoroughly. Choosing slower growing, dwarf types of evergeens will reduce the frequency of this laborious task—which brings us to plant selection.

I strongly recommend you choose your evergreen from those known for their cold hardiness. Colorado winters are brutal on containerized plants and few home gardeners have the inclination or resources to bury or otherwise insulate the containers to protect the root ball from freezing. For many years I've grown dwarf cultivars of Colorado spruce, *Picea pungens*, in containers. A minor disaster occurred one year when an early fall snowstorm broke the top out of a weeping specimen with a weak graft union. A grafted weeping form of larch, *Larix decidua*, has thrived. Cultivars of our native Rocky Mountain juniper, *Juniperus scopulorum*, seem to do well, too. This past year I acquired *Pinus banksiana* 'Uncle Fogey'. This is a dwarf contorted form of the hardy jack pine from northeastern North America so I foresee no problems for it from winter cold.

Recommended Evergreens

On occasion, an evergreen has survived one winter only to succumb the next. These losses are difficult to diagnose, although Colorado never seems to have a "normal" winter; each winter seems to present its unique version of cold season stresses. Evergreens I have grown in containers for a season or two, but lost later, include a Hicks' yew, *Taxus* x *media* 'Hicksii', a dwarf Alberta spruce, *Picea glauca* 'Conica' and a bird's nest spruce, *P. abies* 'Nidiformis'. The spruce should be hardy enough, so other circumstances, such as the difficulty of proper winter watering, may be responsible.

Watering

Watering is a crucial factor in container gardening success. Absolute guidelines are impossible because of the numerous variables. You must consider the species of your evergreen and its particular moisture needs. The location of the container will partly determine the rate of evaporation of water from the soil, and weather, of course, affects the amount of supplemental irrigation necessary.

Seasonally, you will need to water more frequently in the hot summer months than during spring and fall. In winter infrequent watering is usually the rule, but don't forget to water the container plants during the warm, dry periods of a typical open winter season in Colorado. When you water, drench the soil in the container thoroughly, allowing the excess water to drain away, then let the surface soil dry out before watering again. Once evergreens exhibit symptoms of water stress, they are often too far gone to recover, so become familiar with the moisture conditions in the container by digging down periodically and feeling the soil a few inches below the surface. Generally you want to keep the soil moist, neither soggy nor dry.

The Risky Exotics

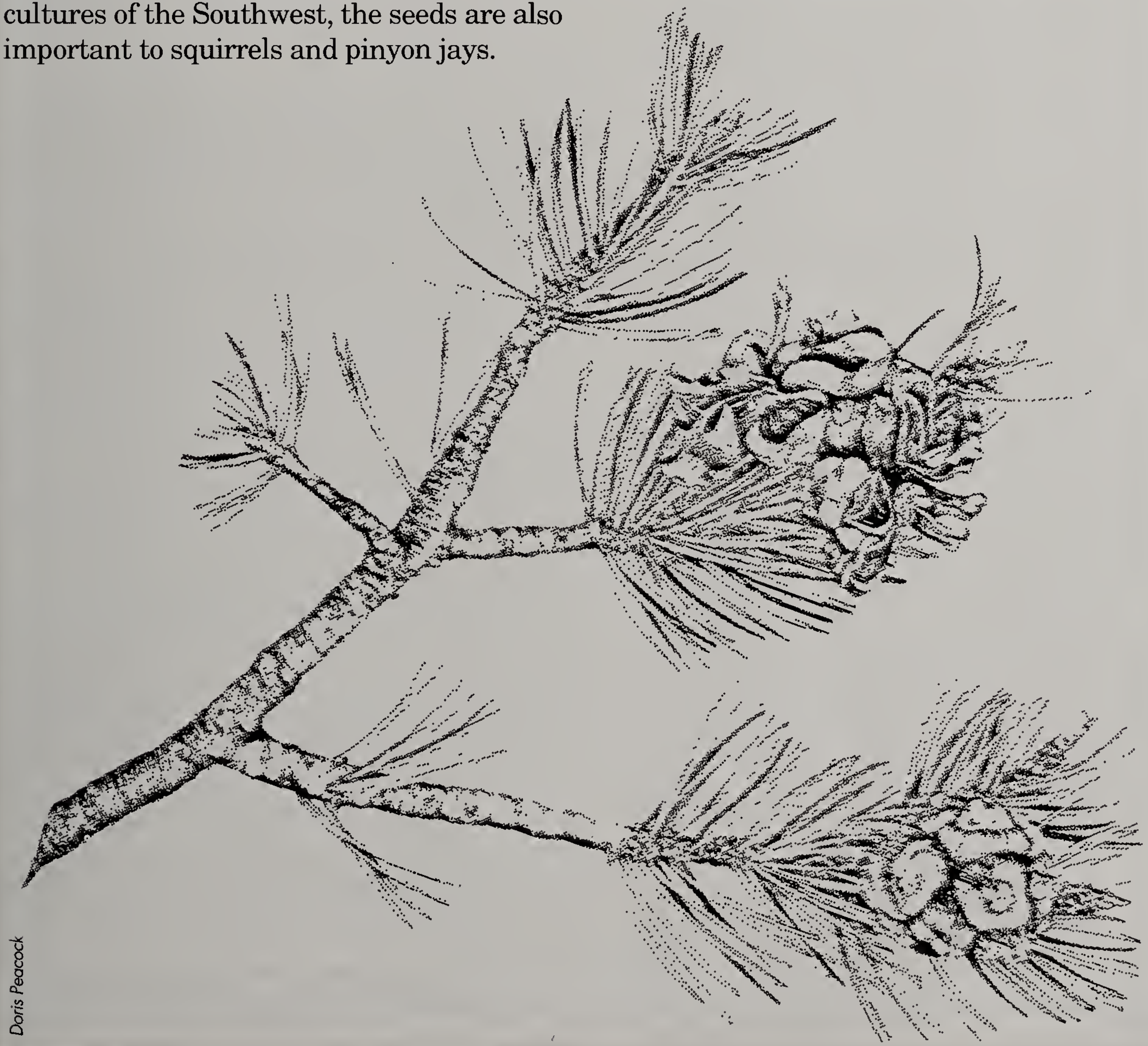
Early in my experience with growing evergreens in containers I optimistically tried some exotic conifers which have marginal records of survival through our winters. Container cultivation practically guaranteed their loss. A weeping Nootka cypress, *Chamaecyparis nootkatensis* 'Pendula', and a beautiful blue Atlas cedar, *Cedrus atlantica* 'Glauca',were two of these.

I have tried some broad-leaved evergreens in containers too. *Rhododendron* 'P.J.M.' survived the winter but suffered dieback. Unfortunately, I cannot recommend broad-leaved evergreens for container cultivation. We Colorado gardeners have enough trouble growing them in the open landscape!

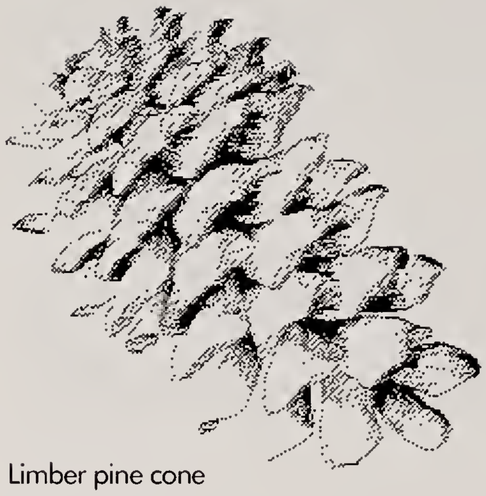
Do you have a spot in your yard or patio where a special container plant could provide focus and interest? Or a situation where living plant material is needed to soften and moderate hard architectural features? Container evergreens are useful alternatives that will provide a refreshing environment every day of the year. ❧

Pinyon Pine

❦ Pinyon nuts, one of the few edible "nuts" that can be grown in this region, are the seeds of *Pinus edulis*, our native pinyon pine. They are higher in protein and carbohydrates and lower in fat than pecans. A favorite food of several cultures of the Southwest, the seeds are also important to squirrels and pinyon jays.



Doris Peacock


Limber pine cone

Why Not Try Limber Pine?

William G. Gambill

Despite its widespread distribution in the Rocky Mountains, from Canada to Mexico, limber pine, *Pinus flexilis,* is one of the least known and most infrequently recognized needle-leaved trees of Colorado. Yet, based on the cultivated specimens seen occasionally in parks and gardens, this tree deserves more careful attention from professionals and the public alike for its horticultural potential.

What does limber pine look like? It depends on where it grows. In general, it is a medium-sized tree 25 to 50 feet tall. Individual trees have been recorded at 125 feet where the environment is favorable, while in harsher conditions the tree is very much dwarfed, resembling a shrub with a rounded crown. Growing slowly, a 200- to 300- year-old-tree may have a trunk with a diameter of 3 feet, although 1 to 2 foot trunks are more commonly seen. An unusually large taproot anchors these trees growing on rocky windswept ridges, bluffs and peaks. In such habitats the trunks tend to be short and thick, often crooked, gnarled and misshapen. Under cultivation, though, they tend to be tall and moderately straight. Young trees have smooth and grayish-white bark, while older specimens are dark brown or blackish and plated.

Foliage and cones are the most noteworthy and attractive aspects of the limber pine. The needles, more slender than those of ponderosa pine, appear bluish-green. The color comes from the white lines of stomates running the length of its needles. Three and a half inches long, they are borne in fascicles (bundles) of five, and are curved slightly inward. Thick clusters of the needles extend back from the tips of the twigs a few inches, their abundance giving the tree a lush, bushy appearance.

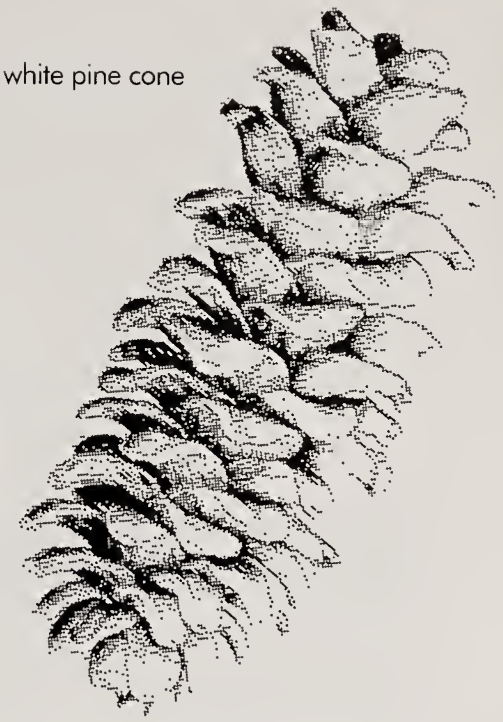
Cones of the limber pine grow 8 to 10 inches long and are nearly cylindrical in shape. When they are new they are green. They become beautifully light yellow-brown in the autumn. The cone scales are very thick, lack prickles, and are only slightly reflexed at the tips. Abundant exudations of white resin occur on the tips of the cone scales, making it prudent to handle the cones with care.

The limber pine has already shown its potential in cultivation along the Front Range. Like many other conifers, it must have a fairly gravelly, well-drained soil to thrive; it does not do well in heavy, clay soils. The late George Kelly, dean of Colorado horticulturists, wrote that limber pine makes a very valuable ornamental tree. For many years, he and others have been advocating its more extensive use.

Why plant limber pine? It is a handsome, native tree and is exciting because of its rarity in cultivation. ❧

William G. Gambill, Jr., is director emeritus of Denver Botanic Gardens, where he continues to teach and lead botanical field trips. His botanical writing reveals his affection toward trees of the Northern Hemisphere.

Southwestern white pine cone



Southwestern White Pine—An Under-Used Landscape Plant

Robert Cox

Local landscape architects and horticulturists may be familiar with our native limber pine, *Pinus flexilis*, and aware of its great landscape value. Less familiar is the limber pine's close relative, the southwestern white pine, due to its infrequent occurrence in remote areas of the southern Rockies.

The southwestern white pine goes by several other common names, including Arizona pine, border pine, and Mexican white pine. To add to this confusion, even its scientific name is not agreed upon. Earlier botanists named it *Pinus strobiformis*, referring to its similarity to *P. strobus*, the eastern white pine. Others emphasize its close relation to limber pine by calling it *Pinus flexilis* var. *reflexa,* referring to its reflexed cone scales, which the limber pine cones do not have. The best name would appear to be *P. flexilis* var. *reflexa,* but when found locally in nurseries it is sold under the older name, *P. strobiformis.* Some other differences between this tree and the limber pine include the southwestern tree's generally longer needles and narrower cones. However, where the distribution of it and the limber pine overlap, the two may be very difficult to distinguish.

The southwestern white pine has attractive blue-green needles in clusters of five. Its dense foliage gives it a softer look in the landscape than Austrian, ponderosa, pinyon, and other two- or three- needled pines.

Like most pines, it prefers well-drained soils without salinity problems. The heavy clays prevalent here should be well amended with organic matter. Full sun is best, partial shade is acceptable. Newly transplanted trees need regular watering. Particular attention should be given to watering young plants during the winter, especially during months when there is little or no snow cover. Mulches such as wood chips or straw help to conserve soil moisture and inhibit weeds. About a year after planting, young trees begin growing fast. The mature size will vary by site and soil conditions but will be approximately 35 to 40 feet tall and 15 to 20 feet wide at the base. After it is established, the southwestern white pine is quite drought-tolerant and a good candidate for xeriscapes. It can be used as a specimen evergreen or in windbreaks.

As a five-needled "white" pine it is susceptible to white pine blister rust and should not be planted near currants or gooseberries, which are alternate hosts for the rust. However, as a five-needled pine, it is resistant to damage from larvae of the pine tip moth, which often damage growth tips of two- and three-needled pines in our area.

There are a few specimens of this tree scattered around the Denver area in yards

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Robert Cox is the Jefferson County extension agent for horticulture. He is author or co-author of articles in numerous publications, including *The Green Thumb, Colorado Green* magazine, *American Nurseryman,* the *Journal of Plant Nutrition* and *Plant Propagator.*

and municipal plantings. Grange Creek Park in Thornton, at 110th and Dahlia, has several on the east side of the parking lot. Glencoe Park in Thornton, at 112th and Glencoe, has examples along the fence on the west end. Several can be found in the City of Aurora Arboretum at Alameda and Potomac Streets. There are a few near the visitor center of Denver Botanic Gardens' Chatfield Arboretum. A beautiful specimen can also be seen in the xeriscape garden of the Colorado Springs Water Department. Although its availability is limited now, with only a few wholesale nurseries handling it, the southwestern white pine deserves to be planted more frequently. Ask for it—and help stimulate greater supply. ❧

Limber pine cone and Southwestern white pine cone illustrations by Jeanne Janish, courtesy of Southwest Parks & Monument Association

Did you know these facts about evergreens?

❦ Two upright evergreens in Colorado often referred to as red cedars or cedars are actually junipers. Western red cedar (also called Rocky Mountain juniper) is *Juniperus scopulorum*; Eastern red cedar is *Juniperus virginiana*. On the Western Slope, what is called a cedar is usually *Juniperus osteosperma* (also known as *J. utahensis*). True cedars are unusual in this region. They belong to the genus *Cedrus* and are hardy only in very protected sites in Colorado.

❦ Bristlecone pines have white specks dotting their needles, giving the branches a slightly "sugared" appearance that is, usually, entirely normal. In fact, the presence of these resin specks is a good way to identify this native pine.

❦ Bristlecone pines are also the oldest living trees on earth. Some of them have been alive for up to 4,900 years.

❦ What makes the blue Colorado spruces so blue is not the color of their needles, but rather a wax, or "bloom," on the needles; it can be scraped off with a fingernail. Some pesticides may also remove the blue color. The Colorado spruce's natural color ranges from blue-green to silver-blue.

❦ Douglas-fir, a beautiful conifer native to our state, is not a true fir (genus *Abies*) like white fir or alpine fir. It belongs to the genus *Pseudotsuga*. Even more confusing, the name "Pseudotsuga" means false hemlock, still another genus of conifer.

❦ There is a simple identification trick when you're looking at evergreen trees: Roll a needle between two of your fingers. Needles of *S*pruces will feel *S*quare in cross-section (*S-S*); *F*ir needles will be *F*lat (*F-F*); and pine needles will always be arranged in bundles of two or more.

❦ The beverage gin gets its characteristic flavor from the fleshy, berry-like cones of junipers.

❦ Due to its resonant qualities, spruce is the wood of choice for musical instruments. Guitars, organ pipes, piano sound boards and violin bellies are usually made of spruce.

❦ There are deciduous species of hollies with simple, untoothed foliage. It is an extremely variable genus.

❦ An easy way to maintain the size of or prune many pines is to simply snap off part of the "candles"—the new shoots that elongate in spring.

❦ The fruits of grape hollies, *Mahonia* species, are edible and make good jelly. However, the fruits of true hollies, *Ilex* species, are quite poisonous and the plants should be considered as dangerously attractive to children.

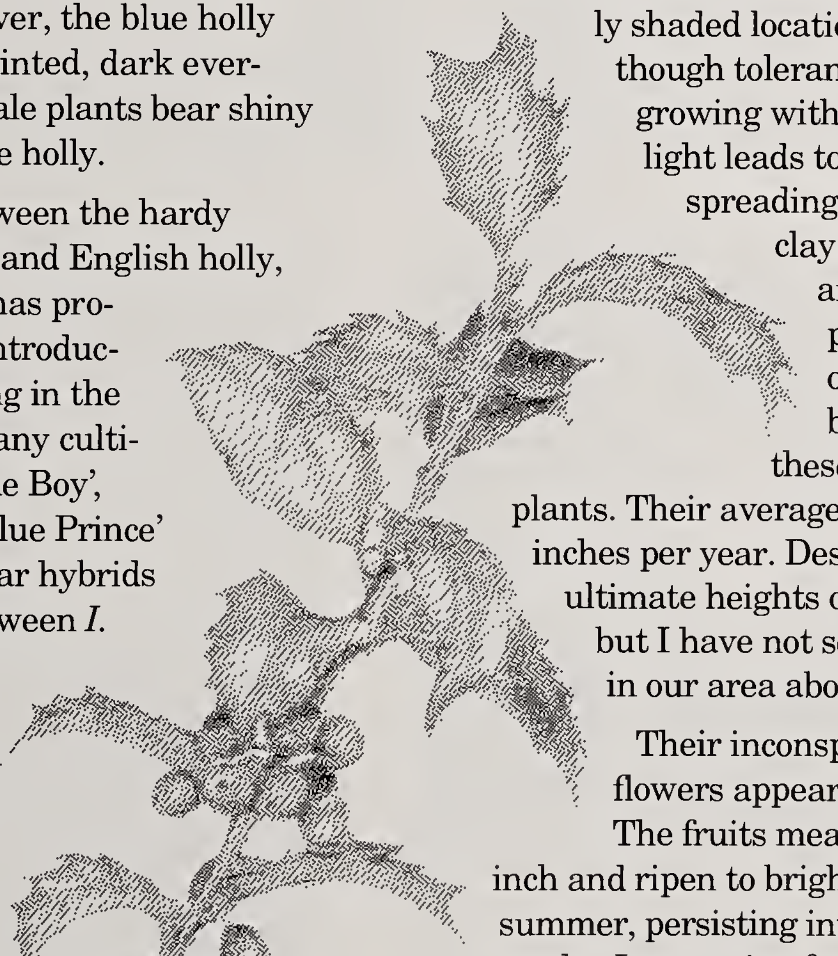
❦ The state trees of New Mexico and Colorado are, respectively, the pinyon pine and the Colorado spruce.

The Blue Hollies: Tough New Hybrids for Our Climate

Ken Slump

Until the introduction of the hardy "blue hollies" (selections of the hybrid *Ilex* x *meserveae*) gardeners in our area had to plant "holly substitutes," such as Oregon grape holly, *Mahonia aquifolium*—not a true holly—or we could briefly enjoy sprigs of the real McCoy from our local florists during the Christmas season. However, the blue holly cultivars have sharply pointed, dark evergreen foliage and the female plants bear shiny red berries that typify true holly.

They are hybrids between the hardy prostrate holly, *I. rugosa*, and English holly, *I. aquifolium*. This cross has provided numerous named introductions that began appearing in the mid-1960s. Among the many cultivars are 'Blue Angel', 'Blue Boy', 'Blue Girl', 'Blue Maid', 'Blue Prince' and 'Blue Princess'. Similar hybrids resulting from a cross between *I. rugosa* and *I. cornuta* are 'China Boy' and 'China Girl'. All of these hollies are dioecious; that is, the male and female flowers occur on separate plants. Therefore, plants of both sexes are necessary for production of red berries. 'Blue Angel' is a female cultivar, and the genders of the other cultivars are implicit in their names.



Glenda Newton

Denver Botanic Gardens acquired its first plants of these hollies in 1975. They vary somewhat in ultimate size, foliage color, growth rate, cold hardiness and flowering and fruiting characteristics.

In the Denver area the blue hollies seem to grow best in protected, partially shaded locations. Even though tolerant of full shade, growing without some sunlight leads to a weak, spreading habit. Heavy clay soils should be amended with peat or other organic matter before planting these humus-loving plants. Their average growth is 3 to 6 inches per year. Descriptions claim ultimate heights of 8 to 12 feet, but I have not seen any plants in our area above 5 feet tall.

Their inconspicuous white flowers appear in mid-spring. The fruits measure about ¼ inch and ripen to bright red in late summer, persisting into the winter months. Late spring freezes typical to our climate occasionally spoil a year's fruit production.

These relative newcomers to local landscapes offer refreshing options for year-round evergreen attractiveness. ❧

Manzanitas

Andrew Pierce

With oval leaves that range from deep forest green to bright apple, the manzanitas are a group of evergreen shrubs that locally deserve greater attention, both from nurseries, who must propagate them for sale, and from homeowners. Their leathery foliage, twiggy form and colorful bark are interesting additions to the summer garden. In winter they are outstanding.

From cold, often dry, boreal areas of the Northern Hemisphere, many of them could be used in dryland scapes to brighten their winter color and relieve the prickly aspect that many of them have. Their smallish white, bright pink or rose-colored, bell-shaped flowers are welcome in any springtime garden.

There are two, possibly three, species of the genus *Arctostaphylos* native to Colorado. Each has characteristics that make it a desirable landscape shrub.

The well-known bearberry, or kinnikinick, *Arctostaphylos uva-ursi,* grows throughout the higher forest regions of Colorado. Ground-hugging in character and with small oval leaves, it is an interesting ground cover in partially shaded locations. I have seen it growing in the sun where it receives adequate moisture, in acid soil. Its small flower clusters are followed by spectacular ¼ inch scarlet fruits. In its natural habitat these are eaten by bears—hence the common name. You may wish to emulate the pioneers, who used the berries for cider and jelly.

From the Western Slope, principally on the Uncompahgre Plateau, comes the green-leaved manzanita, *A. patula.* A larger bush, up to 4 feet, with rich mahogany-red trunks, in the wild it forms interlocking thickets several miles in extent. The fruit is creamy white or yellow and is eaten by several kinds of birds and animals. At Denver's "low" altitude it should be planted in a partly shaded location, in an improved, acid soil.

Intermediate in growth habit between these two species is the pine-mat manzanita, *A. nevadensis* var. *coloradensis.* In fact the pine-mat may be a remnant hybrid between them. (The Colorado subspecies seems to be very stable and is found nowhere but on the Uncompahgre Plateau. Some experts elevate its rank to *A. coloradensis.* The nearest other plants of *A. nevadensis* are in dry, cold places in California.) Whatever the scientists decide, it's a colorful, low—about 2 feet tall—shrub with red fruit and reddish bark, with sprawling trunks that occasionally root at the nodes.

Bearberry is readily available every spring in many nurseries around Denver. As interesting as they are, the other manzanitas are not reliably available, though local nurseries have propagated them sporadically. It is a testament to their usefulness that commercial landscapers buy them up quickly whenever they appear on the market. ❧

Andrew Pierce is senior horticulture advisor at Denver Botanic Gardens. He received his horticultural training in England and now lectures and teaches. His home garden in Evergreen has been featured in several national magazine articles.

Below, green-leaf manzanita from the Uncompaghre Plateau

Walter Fick

Diane Ipsen

Andrew Pierce

Top right, Yucca glauca, sometimes classified as a shrub, augments its evergreen foliage with late spring flowers.

Above, *Opuntia compressa*

Left, Kinnikinick, *Arctostaphylos uva-ursi*

A Few False Cypresses For Your Landscape

Kelly D. Grummons

Over the past five years we've tested several species and varieties of false cypress (*Chamaecyparis*) at Paulino Gardens. Three species and their cultivars have proven to be tough enough for the Rocky Mountain region.

The real trooper is in Grandmother Paulino's garden. It is a weeping Nootka false cypress, *C. nootkatensis* 'Pendula', planted 10 years ago and now graced with long, pendulous branches. Planted fully exposed to the elements, this handsome specimen tree has survived several 30-below-zero winters with virtually no damage and indicates that this variety is a sure bet for any gardener. In its native habitat, the coast of Alaska southward into Oregon, this species can reach nearly 100 feet in height. In Denver, though, it may grow to only 20 to 30 feet.

The Sawara false cypress, *C. pisifera,* native to Japan, is also as hardy as they come. Provided with decent soil, this evergreen should thrive in our area. The cultivar 'Filifera Sungold' grew from 15 inches high and wide to 3-½ feet high by 4 feet wide in five years of testing, never exhibiting any winter desiccation even in full exposure. 'Sungold' has pendulous branches and thin, wiry branchlets of gold. It is a fascinating accent plant for your garden. This year we'll be trying *C. p.* 'Boulevard', an upright blue form.

The other species of false cypress that we've had some success with is *C. obtusa* from Japan. With constant moisture (especially during winter) and rich, well-drained soil, the Hinoki false cypress has performed well, but it is happiest with protection from winter sun. It has an upright, irregular form. At 6 to 8 inches of growth per year in Denver, I would expect a maximum height of 12 to 15 feet. The dwarf cultivar 'Nana Gracilis' is less tolerant of our dry winters and may need extra protection.

False cypresses are not for curators of low-water plants. I've seen Phomopsis blight on stressed plants. Hollow, dry centers and sparse tip growth often indicate winter drought stress, so mulch the roots generously and provide deep, rich, well-drained soils. If you, too, are successful with false cypresses, there are hundreds of cultivars available. You may become a collector.

Note: False cypresses are beautiful conifers whose scaled branchlets arrange themselves in flat, usually vertical fans, so the small trees have a pleated, "arranged" appearance. They have received a less-than-desirable reputation in this region because most examples look brown or "burned" during the winter. This is almost always due to an absence of winter watering. —L.L. ❧

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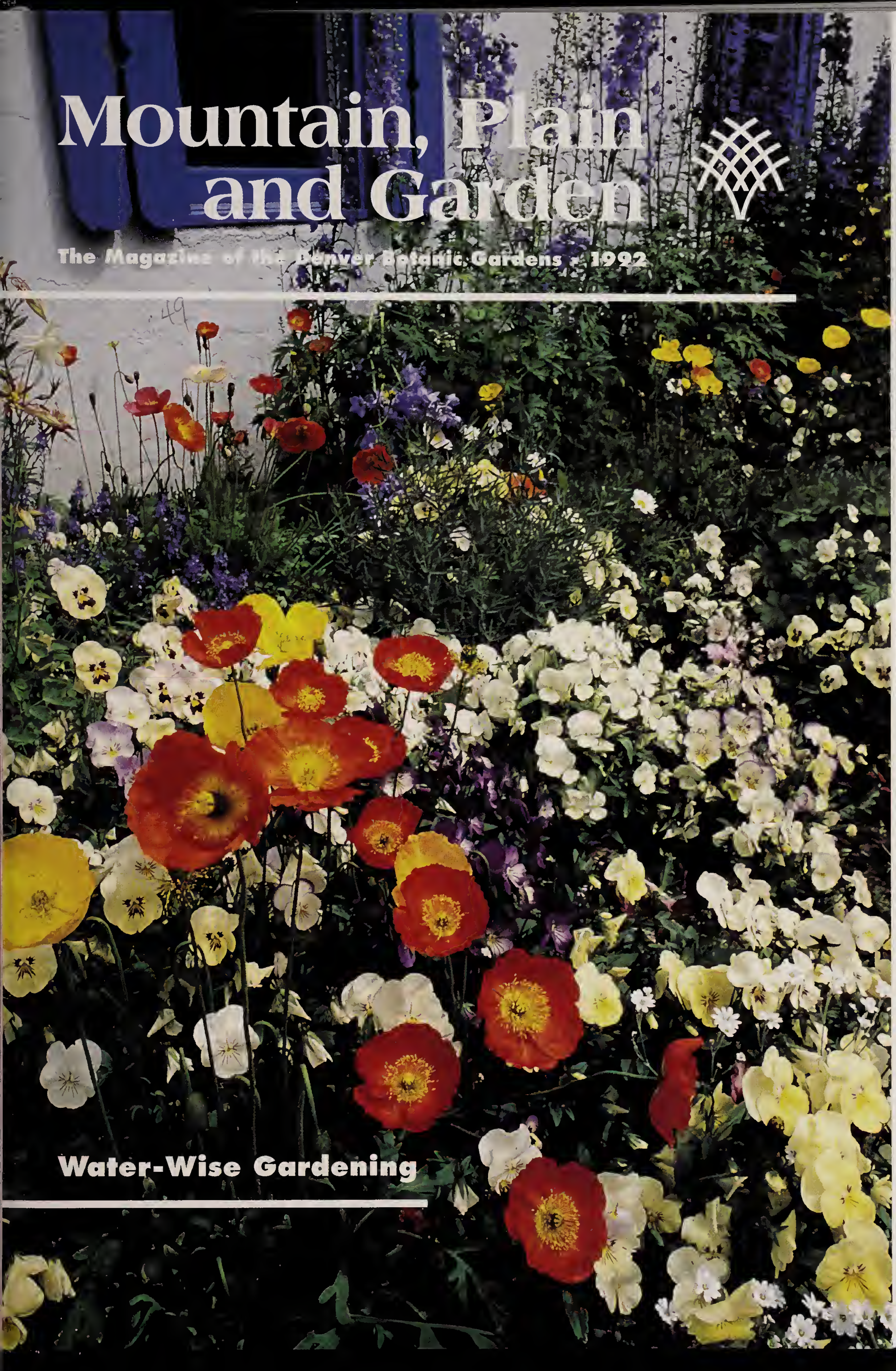

Water-Wise Gardening

Dedication: To George Kelly

This issue of *Mountain, Plain and Garden* has been written with the special memory of George Whitfield Kelly in mind. George was a pioneer who came to Colorado not to dig gold and silver ... but to dig plants and shrubs, always reminding us of the fragile and arid environment in which we live. His life-long work was geared toward the distinction of a Rocky Mountain horticulture.

When George died on August 10, 1991, at the age of 97, people mourned the passing of a man known as "the Father of Rocky Mountain Horticulture." George was also a founder and the first acting director of the Denver Botanic Gardens, the author of countless articles and ten different books, the originator of the Green Thumb radio show, the first editor of the *Green Thumb Magazine* (now called *Mountain, Plain and Garden*), a successful nurseryman, and the first full-time horticulturist with the Colorado Forestry and Horticulture Association.

What is not often remembered is that most of this occured when the average gardener is contemplating retirement.

These articles represent a tangible result of George Kelly's work and love. The unmeasureable, however, is the knowledge and beauty that he passed on to other gardeners, who join his dream of sustaining the jewel-like qualities of the Rocky Mountain West.

—*George Kreiger*

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Mountain, Plain and Garden

The Magazine of the Denver Botanic Gardens

Volume 49 ❦ 1992 ❦ Water-Wise Gardening

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Cover photos, front and back, are by Charles Mann, Santa Fe, New Mexico. Mann photographs plants and gardens throughout the Rocky Mountain West, and his work has been published in leading American horticultural periodicals. He is constantly seeking new subjects for his art; he may be reached at (505) 983-7167.

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Why the Fuss Over Water?

Anna Thurston

- Do you know how much water you alone use every day?

If you are an average citizen of a metropolitan area like Denver you probably use between 150 and 300 gallons of water a day. That's a pyramid of one-gallon jugs taller than a basketball player.

- On average, how much of the water that you use every day is applied to your landscape? (We hope you have a landscape, if you're reading this magazine.)

An average of half of the water delivered to residential homes is used to maintain green landscapes.

- Do you know where your tap water comes from?

If you live on the Eastern Slope, your drinking water might travel a tortuous path up to 200 miles long, starting somewhere on the Western Slope of the Rocky Mountains, piping beneath the Continental Divide, and pumping across vast stretches of countryside.

- Do you know where water goes after it leaves your sink, toilet or gutter? And then, where does it go after it leaves the water treatment plant?

Each one of us is a part of the greater water cycle. The water that was in your orange juice or milk at breakfast this morning may next week be used as drinking water in Nebraska. The same is true for the water that flows down the gutter, with all the leaves, oil and other litter and chemicals that might happen to wash in the same direction. The week after that, the water you used may be in someone else's glass in Mississippi, and later in Europe, or China or back across the Rocky Mountains, where it will again become your water once more.

- What happens when there isn't enough water to go around? Who makes the decision about who gets water and who doesn't? And, if one group of people doesn't get water for their needs (whether here or way out there) do you think that will affect any other groups of people, like us?
- What is the most important resource that you can't work, play or live without?
- Why bother with water conservation?

The conservation world has been howling like the wind lately—howling that we live in an era of dwindling resources. In Colorado water is plentiful. But getting that water to us, when we want it—and at a reasonable price—has become a monumental task.

In other states and other countries, water issues are underlying tinder for war, just waiting to be ignited, building up the longer we ignore the problems of population, overuse, pollution and our tendency to think we can buy our way out of our water resource problems, hoping they'll go away.

Most of us don't want to ignore the problem, but we are uncertain what responsible

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Anna Thurston works as a landscape designer and water conservation specialist. Whether dressed as "Sarah the Snowflake", or just as herself, her interest in water and the environment is shared with schoolchildren, home owners and industry professionals. Anna has a Bachelor of Science degree in Landscape Horticulture Design from Colorado State University. She has taught landscape design at the Denver Botanic Gardens and throughout the Front Range for over ten years.

action we can take. Or, we trust that someone else will "take care of it." This issue of *Mountain Plain and Garden* is devoted to all gardeners in an effort to help each of us understand, not only the why's, but also the how's of water conservation in our landscapes.

The articles compiled herein are written by knowledgeable landscapers and gardeners in our region. They have been asked to share with you their wisdom and ideals. What you'll find is a tapestry of thoughts and gardening methods that will not only make your gardening efforts more efficient, but quite likely, more enjoyable.

Allowing yourself greater involvement with your landscape will also heighten your senses. I will always remember watching as the garlic flowers unfurled and twisted about in the morning sunlight. They moved before my eyes! And I will never forget the wonder I discovered as a child, of seeds turning into plants, that turned into flowers, that turned into seeds again; all of this in seeds blowing from a common dandelion, or in a crunchy pea fresh from its pod.

We do not need to know everything about horticulture to be good gardeners. Certainly classes will help us, but it is ultimately one's attentiveness to the natural world that teaches us the most. Water is a part of the natural world, as are our lovely high plains and Rocky Mountain environments. If we can visit our closest surroundings and become aware of their unique and wondrous properties, we will be able to complement them in our own gardens, rather than controlling and confining these special microclimates with so many mechanisms. This isn't to suggest that we all "go native." It is instead a way of gardening that acknowledges the part of the country in which we live. It will benefit both ourselves and our environment, an environment that we ultimately depend upon.

Here and there you will encounter the word "xeriscape," (pronounced zee-ri-scape). This trademarked (by the National Xeriscape Council) concept is not meant to scare anyone away from gardening. The term itself means "dry vista," but the concept has been developed to follow the thoughts above, of gardening harmoniously with our environment.

Xeriscape is more simply, good, water-wise gardening theory put to practice. It is a whole picture of the landscape in the mind's eye of the gardener. In the end, these practices not only provide you with a landscape that gets used, but also one that won't die at the first sign of an extended drought. Droughts have come before, they will certainly come again.

If you have been developing your garden for many years, you may already incorporate water-wise methods. Newer gardeners will find plenty to digest here. For both we hope that the water-wise garden is not seen as limiting, but rather an enjoyable way to meet and work with the limited resources available to us all.

Designing a Useful Landscape

Gail Barry and Cathe Mitchell

Today, with renewed emphasis on conservation, especially of water, landscapes need to be planned carefully. In considering your own landscape ask yourself some of the following questions: Do I need all the high-water-demand turf area I presently have or could less be used to better advantage? Are plants of similar water need grouped together? Have I taken measures to enrich the soil to reduce the need for water and fertilizer and improve the general health of the plants? Is my current method of watering efficient?

Renovating an existing landscape to save water can seem an overwhelming task. One starting point is to analyze how you use your lawn area. There are variations in peoples' perception of the term "use" Some obvious uses are activities or games such as croquet. Some people use their lawn to stretch out upon or to bury their bare toes into. Others regard the lawn as an area of green upon which their eyes can rest, and don't really "use" it at all.

How much lawn does it take to satisfy your requirements? Can you get by with less? How many funny little pieces of lawn do you have in your yard that serve no real purpose other than to occupy time and money in maintenance and water? What else could you do with that space?

Gail Barry and Cathe Mitchell share a partnership in Land Mark Design, Inc. Land Mark Design, Inc. does a wide variety of small- and medium-scale landscape projects including residential work and is particularly interested in designing appropriately for our environment.

"Xeriscape" vs. "Zero-scape"

The common perception of the Xeriscape concept seems to be of a landscape consisting of rocks and cacti. In the Rocky Mountain region, generations of settlers have altered their environment to mimic that of coastal or Midwestern cities. The attitude has been to conquer the environment rather than to work with it. In the natural environment, rocks and cacti are not as prominent as city dwellers often visualize. Expansive areas of stone mulch and sparse, uncoordinated plantings constitute "zero-scape." Yet properly planned, these elements can be the basis of a very attractive landscape.

In reality, our native landscapes contain an interesting and broad variety of grasses, shrubs, annuals and perennials. Naturally occurring trees are usually found in creek beds. In many rural parts of Colorado, or in the larger landscape, it may be more appropriate to encourage or renovate the natural landscape. For the small urban landscape, however, naturalizing might be considered a form of "zero-scape" because these sites don't blend with the manicured and water-thirsty lawns around them.

Xeriscape is not limited to rocks and cacti, or to naturalization of the landscape. A true xeriscape is one that provides for its owners needs, both physically and visually. The only difference is in how plants are selected, arranged and irrigated so as to conserve water.

There are few limits to xeric landscaping other than those imposed by our climate. Your yard may reflect the character and style of many cultures or parts of the world and still be an efficient landscape. The design, however, must be carefully considered in order to save water and reduce maintenance. Not only will a well-designed landscape reduce water and maintenance costs (up to 60 percent), it can also add beauty to your home, enhancing its value up to 15 percent. If the landscape is planned with your needs in mind it will be used and appreciated.

Things to consider:

Before deciding on a landscape style consider what is really important to you. How do you, or would you, like to use your outdoor spaces?

Also, consider the practical aspects of your landscape. Where are the paths you or your pets tend to follow in your yard? Are you dying to have a vegetable garden or berry patch? Are your plants overgrown? Is your patio or deck large enough?

Other things may be on your wish list. You may want to consider outdoor lighting, a sculptural element, a water feature, a bird feeding area or gazebo. Note unsightly views both from your yard, and into your yard, as well as privacy and security.

Check magazines for pictures of landscapes you like. Look around your neighborhood for places you find appealing. Keep in mind that many of these ideas may not be directly transferable to your property. They are, however, places to begin your planning process.

Short- and long-term considerations:

Monetary considerations are always important. One reason many landscapes include large expanses of lawn is because it's an easy way to cover large areas with an "instant landscape" for a low cost per square-foot. However, the long-term costs of water and maintenance make it a more expensive solution.

Your installation can also be phased in over time to spread out the initial costs of a landscape that includes more plantings. Usually it is less expensive to install paving, decking and other "hard-scape" items at one time.

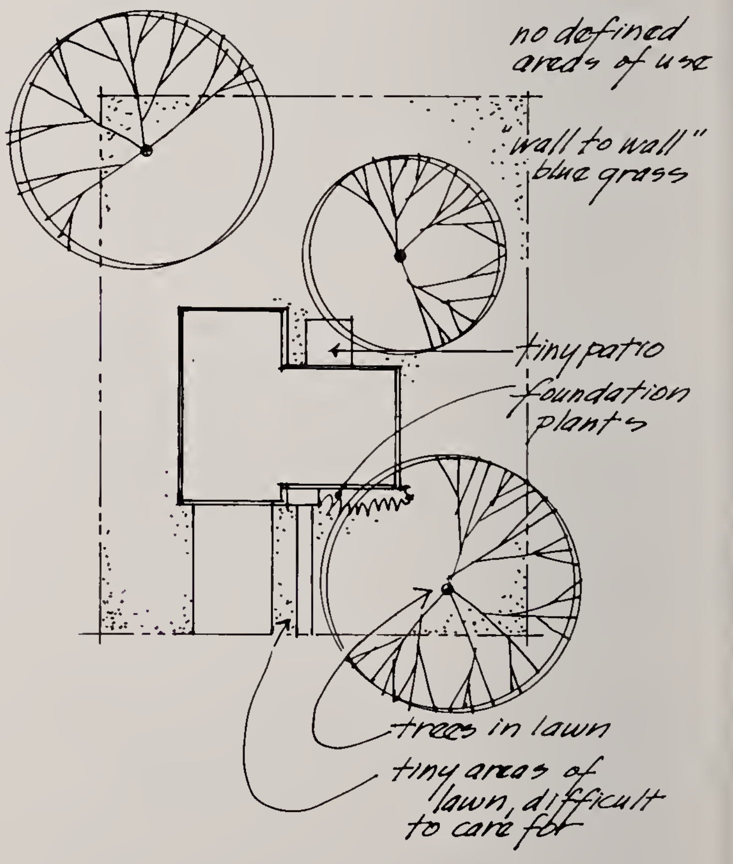
What have you got?

What does your property have to offer? Do you have a flat space or steep hillsides? Lots of existing plants or just a few? A large space or small? Interesting views or eyesores?

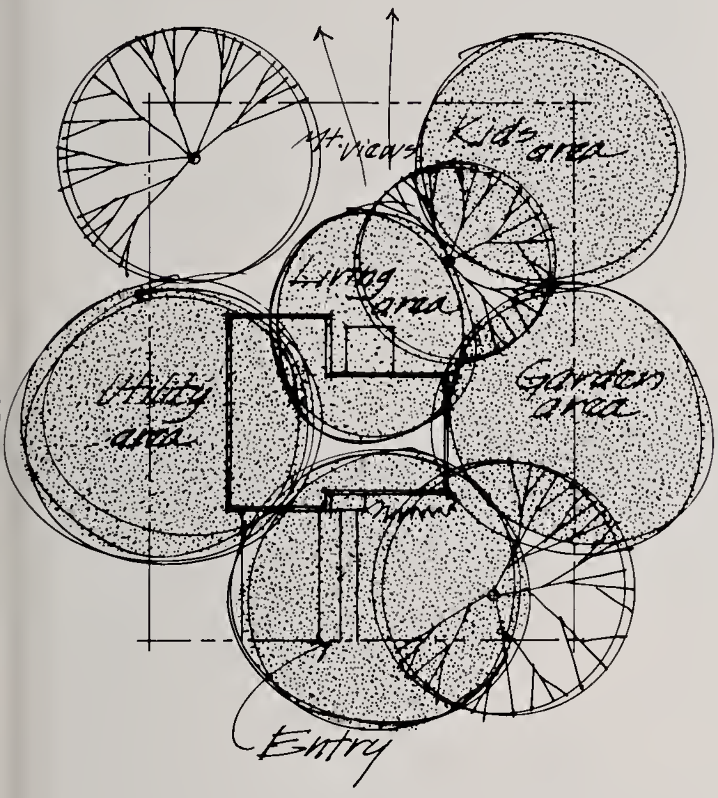
Any of these extremes can be dealt with in your future landscape. Problem areas may become potential amenities. For example, a steep hillside, covered with grass, difficult to water and mow, can be terraced and planted with water-conserving ground covers, perennials and shrubs. Another option is to start a rock garden in this same area. Both ideas can enhance your property and provide interest in all seasons.

Developing the design:

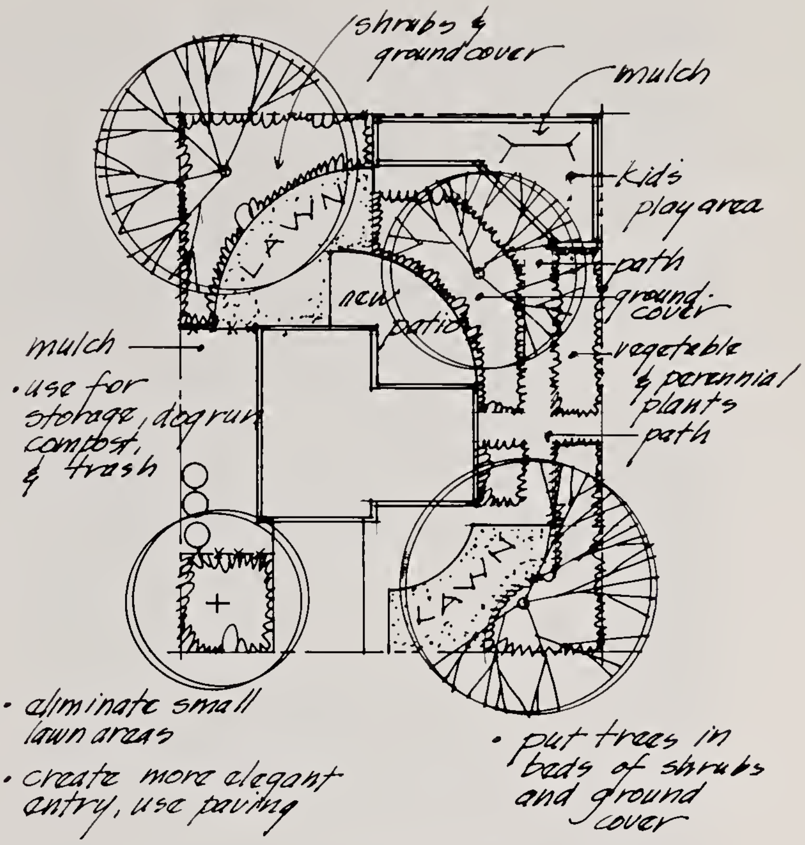
After you have considered what you have and what you want, it's time to develop a plan. Your site needs to be measured and drawn to scale on a sheet of paper (1" equalling 8' or 4' is a convenient scale). Make sure you note the scale on your plan. Mark which way is north and where the utilities are. This is your base map of existing conditions (see diagram A).


no defined areas of use
"wall to wall" blue grass
tiny patio
foundation plants
trees in lawn
tiny areas of lawn, difficult to care for

Use tracing paper to cover and draw upon your base map. Using colored pencils outline and make notes about the areas you are concerned about. Use arrows to show the direction of the prevailing wind and/or harsh sun. Note where your areas of heavy shade occur and/or where the soil is constantly wet or dry. Show unsightly areas you wish to improve, or pleasing areas that you'd like to enhance. If you have a problem with noise or neighbors' windows looking into your bedroom, get it down on paper. These drawings make up your site analysis.


Mt. views
Kid's area
Living area
Utility area
Garden area
Entry

From this information you can proceed to a concept design on another sheet of tracing paper. Here, you will want to make "bubbles" showing areas for improvement or development (see diagram B). Think of the "bubbles" as rooms in a house defining areas that you will use. Arrows can show where you want connections between the spaces and hard lines can indicate walls, screens or barriers. On yet another sheet of paper, final drawings can be made detailing the remainder of the design (see diagram C).


shrubs & ground cover
mulch
kid's play area
path
ground cover
vegetable & perennial plants
path
LAWN
new patio
mulch
• use for storage, dog run compost, & trash
LAWN
• elminate small lawn areas
• create more elegant entry, use paving
• put trees in beds of shrubs and ground cover

Water-Conserving Considerations:

Reducing turf areas, adding patio or deck space, arranging plants with similar water needs together, separating turf from other plantings, and using retaining walls or other terracing devices on slopes are all water-wise ideas to consider. If you want special, exotic or high water-using plants in your landscape group them in areas where you will appreciate them (i.e.: as focal points near your patio or entry) instead of spreading them indiscriminately throughout the site. This also will help reduce the need for maintenance later on.

Need Help?

Landscape architects and designers services range in price from approximately $35 to $100 per hour depending on how experienced they are, how much education they've had and the size of their firm. Sometimes you can get the advice you need from an hour-long consultation at your property. You may also have a designer come and analyze what you need and give you a proposal for a complete design. Some firms provide both design and construction. You may wish to have several bids on the design and then select the best person for your needs. The important thing is to ask for what you want and find out exactly what you are buying.

The Larger Landscape

Don Godi

Large landscapes provide an exciting opportunity to be water-wise. There are several reasons: 1) The price of water can make even the most indulgent landowner think about green money rather than acres of green sod. Many larger landscapes (over one acre in size) are owned or managed by corporations or associations, which are more profit- and expense-oriented. 2) "Tradition" is "out" and the environment is "in" ... well, if not yet the norm, at least to the point of being noticeable. 3) Large landscapes have a difference of scale and can be looked at and enjoyed from a distance rather than walked through and scrutinized. Consequently, they may not require the precision of finish that may be expected of smaller landscapes, which tend to have a more intimate feel and a high water-use and high-maintenance refinement.

Designing water-wise landscapes is more demanding than traditional landscapes. It requires a broader understanding of the elements of design and the design's relationship to the natural sciences in order to complete a comprehensive, high quality, water-wise landscape. This prerequisite and the relative newness of the concept of applied water-wise design tend to limit the quantity and quality of existing water-wise models.

What should be considered when designing a larger water-wise landscape? First, evaluate whether or not a green-lawn, finished landscape is required for the entire site. Is there a natural area worth protecting? Are there remote areas not receiving foot traffic or not requiring a high-impact design? Are there built-in high-maintenance areas on the site such as parking lot medians; steep, south-facing slopes; poor drainage or poor soil? Or perhaps most important, what is the construction budget and how can it be reduced through the application of water-wise landscape design techniques?

Estimated construction costs for developing one acre of landscape:

- Seeding with soil preparation:
  $ .13 per square foot, $ 5,663/acre
- Sodding with soil preparation:
  $ .25 per square foot, $10,890/acre
- Irrigation by automatic, underground system:
  $ .40 per square foot, $17,424/acre
- Mulching, including underlying landscape fabric:
  $ .55 per square foot, $23,958/acre
- Juniper, ground cover (five feet apart, on center) with landscape fabric and mulch:
  $1.50 per square foot, $65,340/acre

And last, but not least, the cost of maintenance:

- "Traditional" full service maintenance for a normal seven month period per year:
  $ .02 per square foot per month for turf and planting (x 7 months) = $ 6,098/acre

For a large site even the minimum development of traditional turf and its inherent maintenance is going to be expensive.

Other considerations may encourage the use of water-wise concepts. The plan should include scheduling of the design and construc-

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Don Godi is principal of Donald H. Godi & Associates, Inc., which emphasizes water-wise landscape design. He also has extensive education and experience in horticulture.

The larger landscape: perimeter of naturalized grasses and flowering perennials

EDAW, Inc.

High-water planting zone near building entry where visitors and employees enjoy the landscape first-hand; also the smallest but most maintenance-intensive zone of the entire landscape

Intermediate watering zone showing plantings of buffalo grass among ponderosa pine tion, supplying water to all landscape areas that need it and determining the availability of compatible low-water-demand plants.

Scheduling planting is important in establishing the landscape. Avoid late fall planting to prevent possible winter damage to non-established plants. Install major plants, such as trees and shrubs, first to achieve a visual impact; then supplement with other planned planting in the future. Seed turf grass at the proper season to match its cool or warm season character of growth.

Design phasing is the only way to effectively deal with limited construction budgets. In such instances it is essential to design functional aspects that are closely attuned to construction practices. Phased design places a priority on infrastructure such as grading, soil preparation, irrigation systems, turf, hard-scapes (walls, walks, water features, etc.) and large plant installation. These items need to be completed first so that future work does not disrupt previously completed areas.

The availability of water is an essential element of the design analysis and conceptual planning. It must be evaluated in the very early stages of the design. Municipalities, such as Castle Rock, Colorado, have begun limiting "traditional" landscape development. They require every project supported by city funds to be designed with water-wise concepts to limit total water use in a site. Higher applications of water to some areas of a site must be matched with lower applications elsewhere to achieve an average application rate.

Plants suitable for use in the water-wise landscape may not be readily available. Certain natives, especially, take time to cultivate and make available to the public. Nurserymen won't grow anything they can't readily sell at a profit. With advance planning and communication, ground covers and native plants, among others, may become available for phased designs.

Although it may seem complicated, alternatives exist for developing larger water-wise landscapes. Design is a subjective process that may produce a nearly infinite number of high quality results for any one site. With that thought in mind, consider the following alternatives for design:

1. Develop a concept which divides the landscape into zones of low-water and higher-water irrigation and plantings that are compatible with site use and the desired visual character. For instance, areas closer to buildings may be designed with turf for higher traffic and water use, floral displays and traditional landscaping. Service areas, natural areas and larger remote areas can balance the site.

Think of the landscape as a golf course with the "green" being the building, the "fringe" being the transition zone, the "fairway" being the water-wise developed area, and the "rough" being an undisturbed or rehabilitated natural area that uses little water.

2. Work within the natural contours of the site so disturbance and overlot grading are minimized. The powerful desire to overwhelm nature can no longer be tolerated, even in urbanized locations. Less disturbance means less costly development and rehabilitation. Indigenous or adaptable exotic plants can be added to mountain, foothill or plains landscapes to renovate them.

3. Use a design that specifies low maintenance as a major element of the design. Build in low maintenance with a combination of site, landscape and irrigation system design that works to limit water use, while providing for the green look that you desire.

These are the landscapes that will not require major renovation in the future and are not a financial drain on their owners or managers. They also are the landscapes that will become classics and will mature into beautiful examples of water-wise design, installation and maintenance.

Entering the 'Plant Zone'

Anna Thurston

Even though choosing the right plants is one of the most important—and easily the most obvious—decisions in designing a successful water-wise landscape you should examine other aspects during your planning phase.

First, you should consider "zoning," or positioning together plants which have similar needs. This will not only save a great deal of water in the years to come, but will reduce long-term maintenance as well.

Take a look at nature's own examples. In mountainous regions you can see the landscape segregated into zones, or microclimates, related to exposure to the sun. Firs and spruces grow on northern slopes. Aspens grow among them, not interspersed, but in groves, usually along drainage ways where the soil is loose and nearly always wet. This is a zone of shade where snow may not melt all winter long.

Along a river you will find water-loving shrubs such as river birches, alders, dogwoods and willows, and riparian plants such as cattails, rushes and sedges. Even though this is a wet zone, note that the river is always moving. Therefore, the water is highly oxygenated.

On either side of the river bed may be flat bluffs that support grasses and low-growing shrubs. If these are in the sun, this microclimate may resemble an open, grassy prairie. In the shade, or where snowmelt is consistent, the shrubs will predominate.

Slopes opposite the northern exposure may have easterly, westerly or southerly faces, depending on geological movement and erosion in the past. Each exposure and its associated drainage may host entirely different plant populations.

You can emulate these natural divisions in your landscape by zoning it. Having given due consideration to how you will be using the different parts of your landscape, decide how much of it you will devote to high, moderate and low water zones.

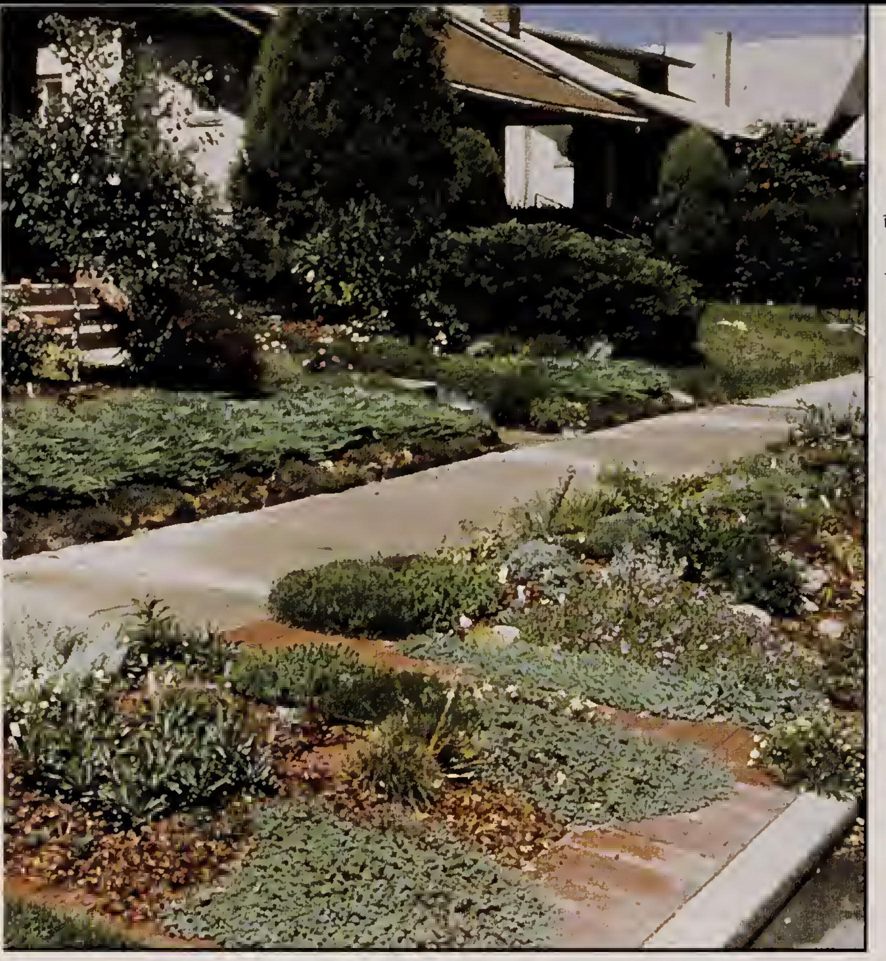
If you consolidate the high water zones, such as lawns and perennial plantings, into areas that will be seen and used often, then devote the remainder of your landscape to lower water zones, you will realize significant savings in water.

Maintenance needs, too, should be zoned before you choose your plants. It is especially important to separate lawn areas from plantings of trees, shrubs, perennials or annuals. Unless your lawn will consist of native turfgrasses, such as buffalo grass or blue grama, and will be allowed to go dormant during summer's heat, it must be considered a high water zone. Trees or shrubs planted within turf zones are not only subjected to overwatering and "lawn-mower-itis," but these islands amid lawn are difficult to irrigate efficiently and make it harder to maintain (mow) your turf.

Only after you have established your water zones should you move on to choosing the plants for each zone.

There is some debate in the industry about how much water certain plants need and into which zone they should fit. Numerous lists have been compiled, but the variation among landscape sites suggests we should use these lists only as general guides.

Spend some time learning about the plants you want to use. Talk to local nursery



Anna Thurston

Above, although more maintenance-intensive, this parking strip is pleasingly designed to provide year-round interest and save water.

salespeople. Most veteran nursery staff members will have grown the plants they sell.

Look around your own neighborhood. Note where and how each plant is growing. Is it in full sun? Partial shade? Is it protected from drying winter winds? How long has it been growing in its particular location? Does it appear to be healthy?

Your county's Colorado State University extension horticulturist and the staff members of the Denver Botanic Gardens are other good sources of information. There are also numerous books about plants for this region. Most useful are ones by local authors about indigenous plants or non-natives that are well suited to our soils and climate. Books about wild plants of the region, though very valuable, will mention many plants not yet available in our nuseries. Your requests for these plants, however, may encourage nursery people to stock them.

Above, cottonwoods near Chatfield Arboretum growing near a stream

Building Your Soil—Carefully

Tony Koski

Most Colorado soils are notorious for making home gardening and lawn care difficult. It seems that few gardeners experience the joy of inheriting a "good" soil here. We have to work at producing that ideal garden soil, one with about five percent organic matter and an equal distribution of large air pores—to supply oxygen to roots and to promote drainage—and smaller open pores—to hold precious moisture.

Most Colorado soils are high in clay and low in organic matter. We must irrigate more frequently than we would like, especially if we are growing less drought-resistant plants.

What can be done to these typical Colorado soils to increase the availability of water to our plants and reduce the frequency of irrigation? One solution is to add organic matter.

Choosing an Organic Source

Before buying organic material you should determine what you want to accomplish with your soil.

If you have a heavy clay that drains poorly, is like cement when it dries and doesn't seem to encourage healthy roots, then it is best to add an organic material that is coarse or fibrous and not highly decomposed. Try partially composted leaves and grass clippings, pine needles, composted and aged manure or—best of all—nitrolized aspen wood. When these materials are decomposed by soil microbes, "glues" (actually sugars) are produced that help to stick small soil particles together into larger aggregates, creating the friable, crumbly soil structure in which plants thrive.

If you are dealing with sandy soil, organic matter that is finely divided or well-decomposed is preferred. The finer particles create smaller pore spaces which retain more water for your plants. Some suggestions are well composted plant residues, well composted manures and processed sewage sludge.

Many organic materials work equally well in clay or sandy soils; they have a good mix of fine and large particles. Composted plants—including bark, leaves, grass clippings and food wastes—well-composted animal manures and processed sludge are all effective amendments for a variety of soil types.

How Much Do I Use?

At first, a general rule of thumb in the Rocky Mountain region is to spread about three cubic yards of material over each 1,000 square feet of soil surface (that's about 2" deep), then incorporate it to a depth of about 6". This can be done every year in a vegetable garden or other areas that can be cultivated often.

On established lawns, a light topdressing (1/2" - 3/4"), once or twice a year, is beneficial, especially if you apply it after core aeration, using a well-composted material. Avoid topdressing with sphagnum moss or peat; they can repel water and cause irrigation problems.

Tony Koski is an assistant professor in the horticulture department at Colorado State University and the CSU extension turfgrass specialist. His research investigates methods for more efficient irrigation of turf and the evaluation of turfgrasses for use in the Rocky Mountain region.

Other Benefits of Organics

Besides their effect on soil structure, organic materials provide other benefits to your plants. Many provide substantial levels of micronutrients, such as iron, manganese and copper. Organic matter also protects these micronutrients from being tied up by other chemicals in high-pH soils. Additionally, adding organic matter can lower the pH of soil, though it will take many years.

Finally, the use of organics can expand the number of beneficial microorganisms in your soil. Scientists have found that the use of composted plant and animal by-products results in significant reduction of disease problems for garden plants and lawn grasses.

For example, hardwood and pine bark composts, municipal sludge compost and well-composted dairy manure, as either soil amendments or mulches, can reduce or eliminate problems with *Rhizoctonia* and *Pythium* diseases. And using a feather/bone/ grain meal fertilizer; a dehydrated turkey waste product; or a dehydrated poultry waste fertilizer, may reduce the severity of necrotic ring spot disease in Kentucky bluegrass lawns, a major disease problem in Colorado.

But Be Careful!

Just because a product is labelled as an “organic soil amendment” does not mean that it is a good-quality soil amendment.

What should you look for? One concern is weed seed and pathogen content. Long-term composting will kill harmful organisms and increase populations of beneficial organisms. Weed seeds are often a problem in manure products, especially if they are not aged or fully composted.

Another dangerous element of some organics is salt. Improperly composted manures are often high in soluble salts; they can damage sensitive plants. Some peat, especially that mined in Colorado, also contains high levels of salts. The salt level of high-quality products will be on their labels. This level should be less than one mmho (the practical unit of conductance equal to the reciprocal of the ohm; one mmho = $1/1000$ ohm), but one to five mmhos is acceptable if you incorporate it into the soil thoroughly and seldom use it.

Also, mining fens for peat is destroying habitats. Informed gardeners should select other materials for amendments to soil. Some sewage sludge composts contain heavy metals —cadmium or lead. While they are rarely harmful to plants, they may build up in soils where vegetables are grown, presenting a hazard to humans. Municipal sewage sludge should have less than 500 parts per million of cadmium.

Finally, make sure that you are buying organic matter. Some products may contain only 10 percent, the rest being clay, silt or “topsoil.”

So read the label. Be suspicious of products priced much lower than their competitors. Good quality costs more—you get what you pay for.

Designing With Water Use In Mind

Jim Knopf

When developing a truly water-efficient design, it is very useful to calculate the total *amount* of water that each zone in the design is likely to need in a typical season. The accompanying worksheet offers a convenient way to do this.

Estimating water *bills,* however, is somewhat more difficult, because cities use many different methods for calculating water use, and because water rates change frequently. The following three plans, created for the same property, illustrate how significantly water use, and resulting water bills, are affected by different designs. A hypothetical water rate has been applied to illustrate the use of the worksheet. Construction costs in this study were based on estimates provided by two landscape contractors who were asked to review the designs and prepare bids.

Example #1: Water-Wise Foothills Style Design

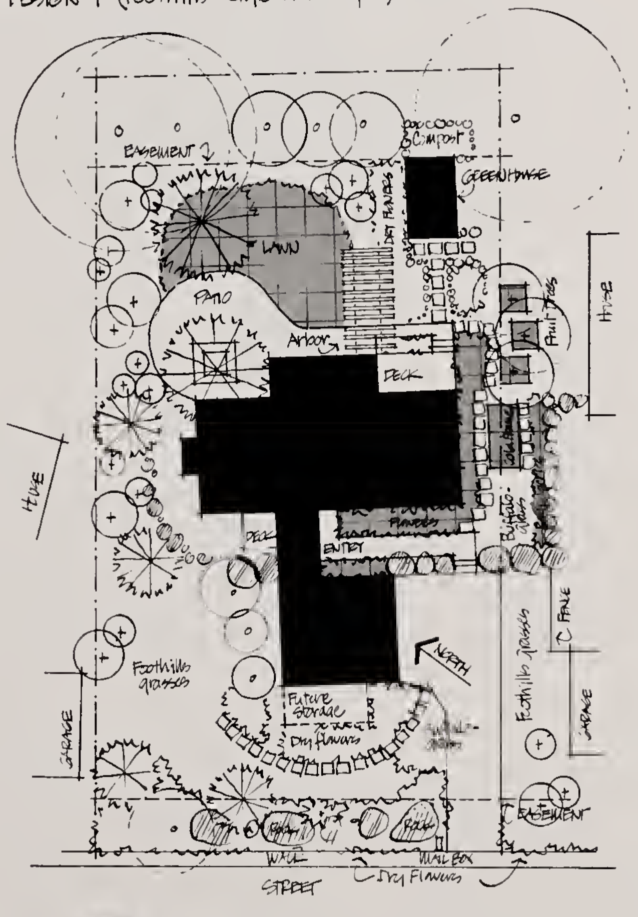
This design would look similar to the local foothills landscape. Maintenance would be very easy; the small watered lawn would require only about five minutes to mow, and the rest of the yard would not require regular weekly maintenance. Because the only areas that require regular watering are small, the need for an expensive automatic sprinkler system is eliminated. Adequate water can be supplied by two settings of a manual hose-end sprinkler, plus a simple do-it-yourself drip system that hooks into the end of the hose that is left in place in the garden.

Construction of the design would be relatively inexpensive because much of the site is seeded, rather than sodded. Many of the shrubs and flowers can also be installed in small sizes.

What it costs and what it saves:

Original installation cost:	$.93/sq. foot
Water use (20-week season)	18,168 gallons
Water Cost (20-week season)	
Boulder	$35.
Lafayette (minimum charge)	$133.
Pine Brook Hills	$400.

■ DESIGN #1 (Foothills style Xeriscape)


EASEMENT
Compost
GREENHOUSE
LAWN
Dry Flowers
PATIO
Arbor
DECK
HOUSE
Fruit Trees
Buffalo grass
Flowers
ENTRY
FENCE
Foothills grasses
NORTH
Future storage
Dry Flowers
GARAGE
Foothills grasses
GARAGE
EASEMENT
WALL
MAIL BOX
STREET
Dry Flowers

▨ = irrigated areas (moderate watering zones)

Jim Knopf is a Boulder landscape designer. This article is adapted from his book, *The Xeriscape Flower Gardener—a Water-Wise Guide for the Rocky Mountain Region*, Johnson Publishing Co., Boulder, Colorado.

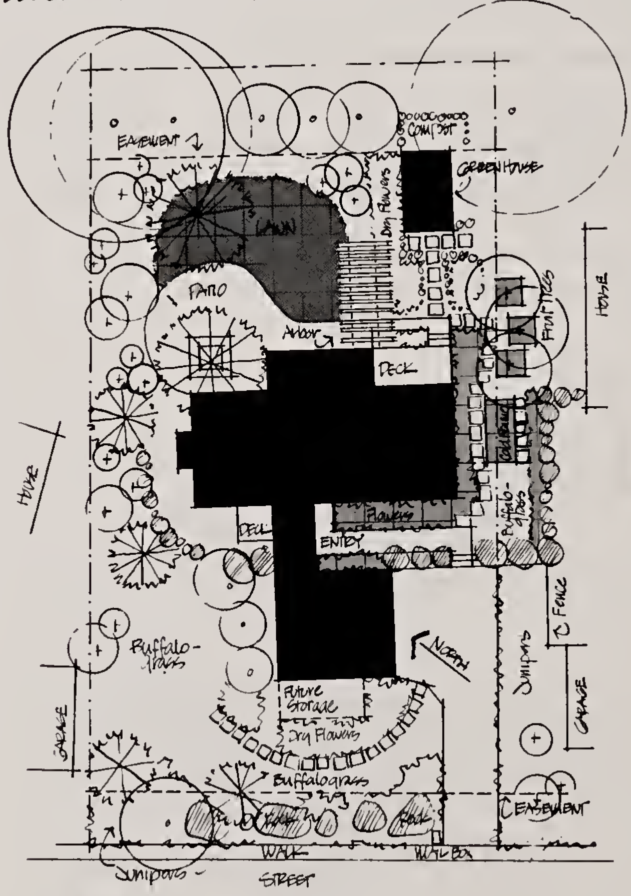
Example #2: Suburban Style Design

This water-wise design looks like a typical manicured and clipped suburban subdivision landscape. It illustrates that the xeriscape approach to design provides the possibility of creating almost any appearance that might be desired. Maintenance would be somewhat more than Example #1, but would be considerably less than for Example #3, because the buffalo/blue grama grass lawn and other areas require far less regular maintenance than Kentucky bluegrass.

What it costs and what it saves:

Original installation cost:	$1.09/sq. foot
Water use (20-week season)	19,316 gallons
Water Cost (20-week season)	
Boulder	$36.
Lafayette (minimum charge)	$133.
Pine Brook Hills	$425.

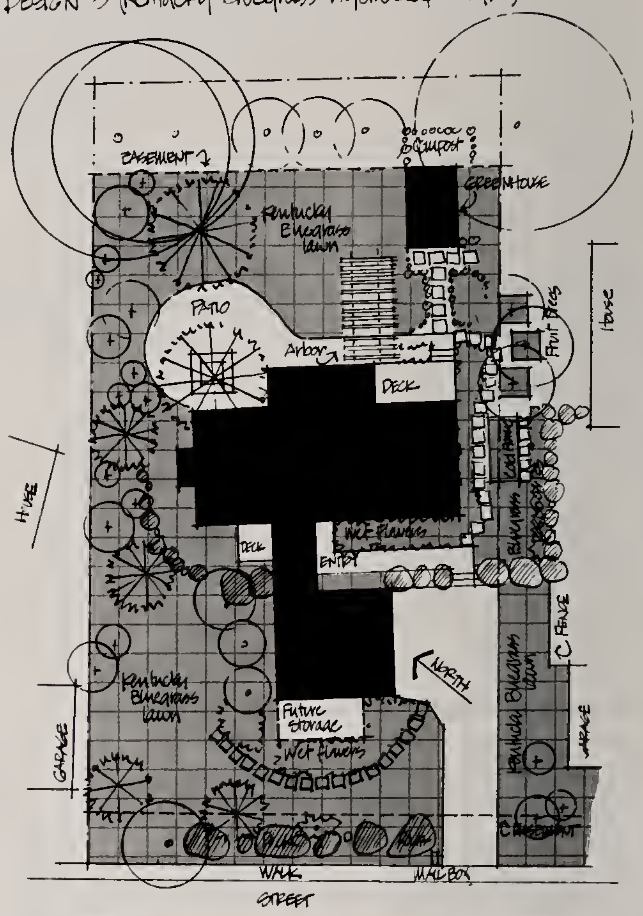
■ DESIGN #2 (Suburban Style Xeriscape)



EASEMENT
COMPOST
GREENHOUSE
LAWN
PATIO
Arbor
DECK
Dry Flowers
Fruit Trees
HOUSE
HOUSE
Buffalo-grass
ENTRY
NORTH
Future Storage
Dry Flowers
Buffalograss
Juniper
FENCE
GARAGE
GARAGE
EASEMENT
WALK
MAILBOX
Junipers
STREET

▨ = Irrigated area (Moderate watering zones)

■ DESIGN #3 (Kentucky Bluegrass "Hydroscape" Style)



EASEMENT
Compost
GREENHOUSE
Kentucky Bluegrass lawn
PATIO
Arbor
DECK
Fruit Trees
HOUSE
HOUSE
Wet Flowers
DECK
ENTRY
Kentucky Bluegrass lawn
NORTH
Future Storage
Wet Flowers
Kentucky Bluegrass lawn
FENCE
GARAGE
GARAGE
EASEMENT
WALK
MAILBOX
STREET

▨ = irrigated area (High watering zones)

Example #3: Hydroscape Style Design

This design is dominated by watered, manicured lawn. The large lawn would require several hours of mowing and trimming, at least once per week, for up to five months. Missing a mowing for even a few days, would be immediately apparent. The design would require an expensive and extensive automatic irrigation system because of the complexity and extent of the areas requiring water up to three times a week.

What it costs and what it saves:

Original installation cost:	$1.14/sq. foot
Water use (20-week season)	137,016 gallons
Water Cost (20-week season)	
Boulder	$248.
Lafayette (minimum charge)	$998.
Pine Brook Hills	$3,014.

Threeleaf sumac

Worksheet for Estimating Landscape Water Use

1. High Watering Zones (18-20 gallons/sq. foot/season)

Lawn (Kentucky bluegrass) ______ sq. feet
Shrubs ______ sq. feet
Ground covers ______ sq. feet
Flowers ______ sq. feet
Other ______ sq. feet
TOTAL SQ. FT. for High Watering Zone ______ sq. feet x 18 gallons/sq. ft.

TOTAL 20-week water use for High Watering Zones ______ gallons

2. Moderate Watering Zones (10+/- gallons/sq. foot/season)

Lawn (Turf-type tall fescue) ______ sq. feet
Shrubs ______ sq. feet
Ground covers ______ sq. feet
Flowers ______ sq. feet
Other ______ sq. feet
TOTAL SQ. FT. for Moderate Watering Zones ______ sq. feet x 10 gallons/sq.ft.

TOTAL 20-week water use for Moderate Watering Zones ______ gallons

3. Low Watering Zones (0 to 3 gallons/sq. foot/season)

Lawn (buffalo/blue grama grass) ______ sq. feet
Shrubs ______ sq. feet
Ground covers ______ sq. feet
Flowers ______ sq. feet
Other ______ sq. feet
TOTAL SQ. FT. for Low Watering Zones ______ sq. feet x 3 gallons/sq. ft.

TOTAL 20-week water use for Low Watering Zones ______ gallons

TOTAL 20-week Landscape Water Use (1+2+3) ______ gallons

The Dry Cottage Garden

Lise Mahnke

You've been drooling over those English gardening books again, wondering how you'll ever pull it off. You know it takes time, money, ample space and precious resources to garden like that. Short of a full-time professional gardener and a mammoth humidifier, odds are against the grand border gardens of England surviving Colorado's cold, dry winters and sun-baked soils. So why not consider combining the root of the border garden—the cottage garden—with our unique environment? You could develop a thoroughly modern, old-style English garden.

Cottage gardens had their humble beginnings centuries ago around the lower-class cottages of rural England. Out of necessity, to supplement their diet, people began growing vegetables, herbs and a few flowers on the small patches of land adjacent to their cottages. Through the exchange of seeds and cuttings among friends and neighbors these gardens grew in variety and beauty. Later, around the turn of the twentieth century, cottage gardens became very fashionable among the more affluent landholders who uprooted great expanses of formal gardens to install the trendy new style.

The element which defines a classic cottage garden is a small site, which may appear quite unruly—in a natural sort of way. The lack of space has driven the gardeners to use every inch of what is available as efficiently as possible, spending more effort coordinating bloom times than using any predefined formula. The plant combinations that result are personal experiments in a constantly changing palette of color and texture. Plants that have become classics of the English cottage style are inexpensive, easy to grow and propagate, or are useful as food or medicine. They satisfied the desire for the beauty of blossoms amidst the blackened cities of industrial England.

What, you ask, does this have to do with your garden, baking in our infamous sun, with little rainfall or humidity to nurture those English darlings?

The essence of a cottage garden is the expression of your likes, needs and ingenuity. It is also a product of the opportunities and limitations unique to your site, resources and time. Often the most limiting elements can provide the best potential for creative solutions to a design problem.

Colorado offers opportunity galore for the modern gardener seeking to recall the gardens of our pasts. Because of our sparse moisture we have few diseases and pests. Our determination to water efficiently will introduce us to new plants from around the world. Eventually we will develop a new style of our own, rich because of the anomalies of our location.

Take time to evaluate your specific site, needs, and preferences, and ponder the following:

Consider the source. The more closely a plant's natural needs match your planting sit-

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Lise Mahnke is a "refugee" from the interior design and architecture field. An advanced master gardener, she now runs her own garden design and maintenance business, Earth Mamas, which emphasizes water-wise and ecological gardening techniques.

uation the happier the plant will be. You won't have to make heroic efforts to keep that plant in its prime. Use annuals that self-seed, such as California poppy (*Eschscholzia californica)*. Don't put a certified low-water plant, such as ice plant (*Delosperma nubigenum*) or paperflower (*Psilostrophe tagetina*), in your best soil with frequent watering. If your soil is clay, find plants that thrive in clay, such as wild four-o'clock (*Mirabilis multiflora*) or the decorative grass, sideoats grama (*Bouteloua curtipendula*).

Dry shade presents a challenge to the water-wise gardener; most shade plants love moisture. Experiment with plants that grow in dry semi-shade. For example periwinkle (*Vinca minor*), similar to the classic cottage plant, *Vinca major*, tolerates dry shade. If the area can support no other plant, try goutweed (*Aegopodium podagraria* 'Variegatum') or sweet woodruff (*Galium odoratum*). Both plants can be invasive if they receive extra water. It is important to remember, though, that any plant will need extra water to become established after being planted. This establishment period can last any where from one to three years depending upon the initial size and health of the plant.

On steep slopes utilize plants with aggressive root systems to prevent erosion, such as pussytoes (*Antennaria* spp.), snow-in-summer (*Cerastium tomentosum*) and fleece flower (*Polygonum cuspidatum* 'Compactum')—watch this one—it can take over your yard!

For best results match the plant to the site: reversing this logic leads to the next point.

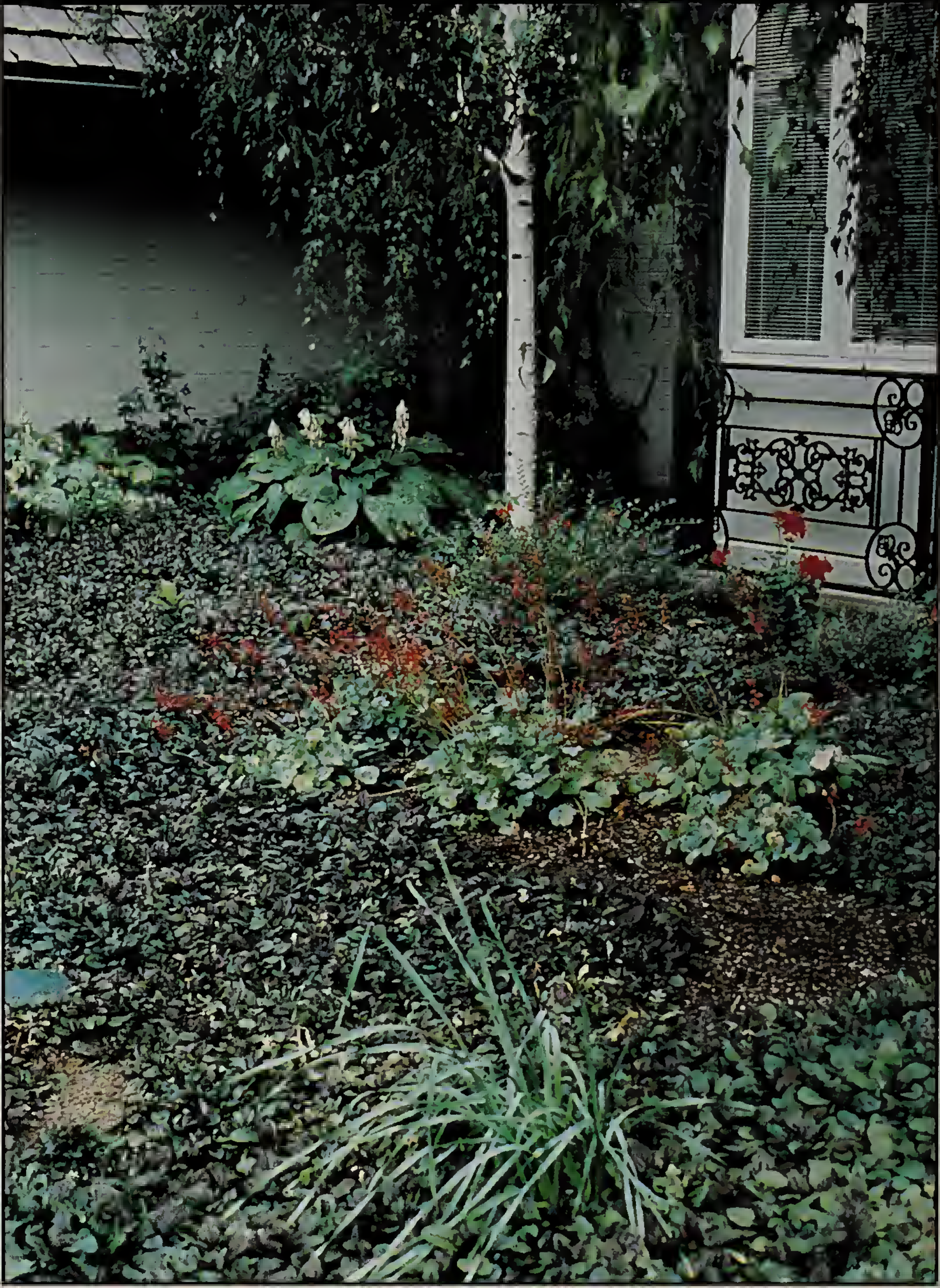
Every task takes longer than it should. Underestimate the time you have available to garden. A traditional perennial garden can require much maintenance—deadheading, dividing, fertilizing and other nurturing tasks. Consider plants that are copious bloomers without the need to deadhead, such as chocolate flower (*Berlandiera lyrata*), or specimens that have interesting seed pods after they finish blooming, such as butterfly weed (*Asclepias tuberosa*). Choose plants that bloom for extended periods of time, such as poppy mallow (*Callirhoe involucrata*). Leave plants in their natural form: Shearing and pruning a plant that is too big for its allotted space takes a lot of time, and may expose the plant to disease and insects.

Plan ahead for the whole year. Remember how awful the sand and dirty snow looks come February? You can plan to have texture, color and interest all year. Choose an architectural feature—a fence, walkway or sculpture—that provides interest in winter. Include deciduous woody plants that have colored or textured bark or evergreen foliage plants. Warminster broom *(Cytisus* x *praecox)* has an interesting evergreen spiky form that combines well with ornamental grasses. Blue mist spirea (*Caryopteris* x *clandonensis*) with it's frothy seedheads looks good against an evergreen background of Oregon grape holly (*Mahonia aquifolium*) or against other evergreens.

In the warm season a water feature can actually save water, compared to an equal area of lawn, while providing a "steaming" or frozen focal point in winter. You can even have flowers blooming in late winter from plants such as Christmas rose, (*Helleborus niger*) or wooly veronica, (*Veronica pectinata*). Or consider selecting a plant as a focal point that has four-season appeal. Serviceberry (*Amelanchier alnifolia*) has white, fragrant flowers in the spring which develop into blue fruit for summer. Come fall, the small tree bursts into flame-red, exposing it's berries against the grey bark and attracting birds for a winter feast.

Plan before you start. Have a general theme based on color, texture, favorite flowers, edible landscaping or any other idea that will give you a starting point in your design. Try not to labor over this plan; instead, use it as the beginning.

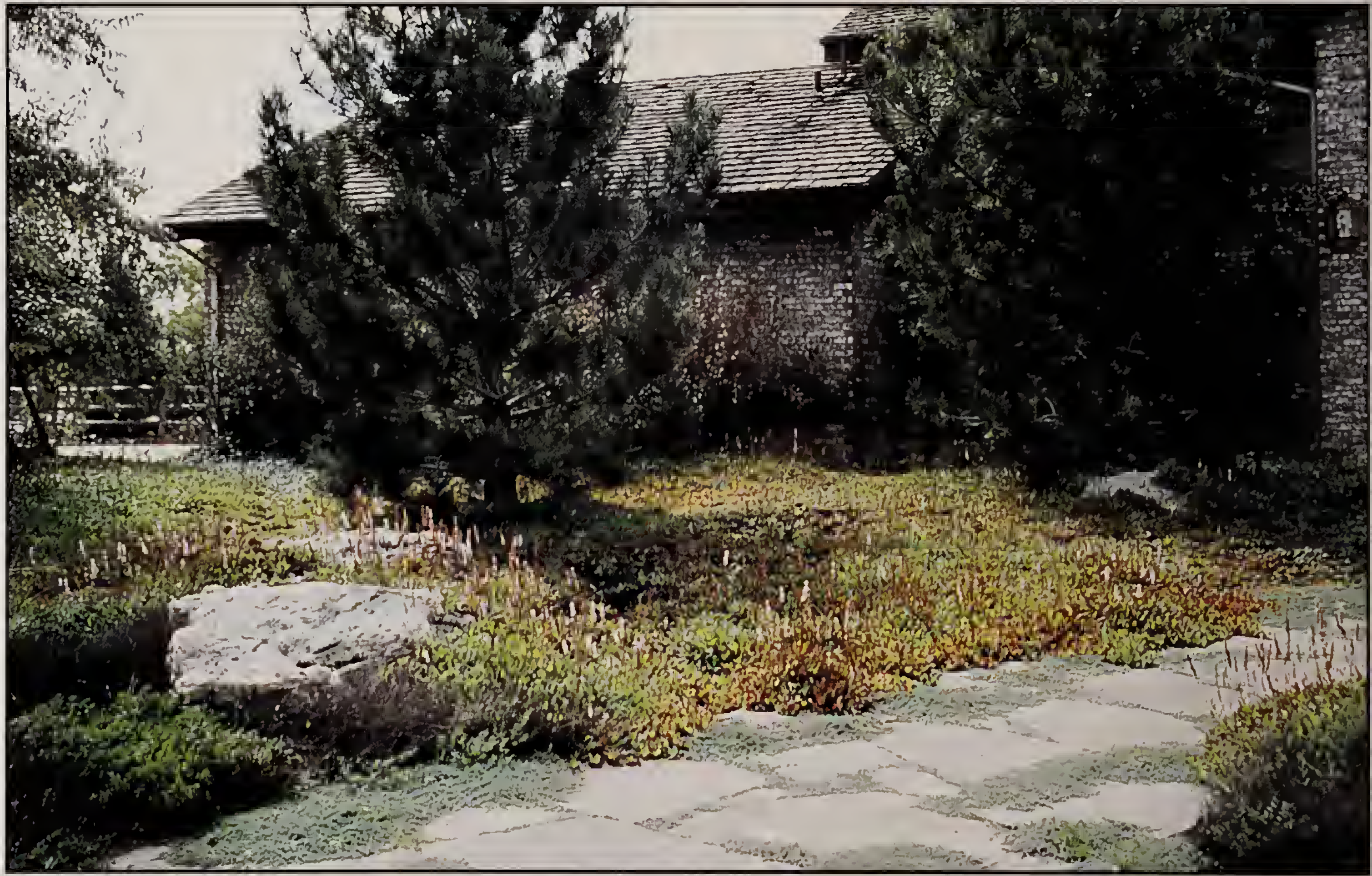
Experiment. Combine odd textures like the yuccas with creeping baby's breath (*Gypsophila repens*) or red hot poker (*Kniphofia uvaria*) with the detailed foliage and chartreuse blooms of lady's mantle (*Alchemilla mollis*). *Verbascum undulatum*, a biennial bearing a faint resemblance to saguaro cac-



Anna Thurston

Right, this shaded garden designed by Alan Rolinger includes hostas under the weeping birch (*Betula pendula*), purple carpet bugler (*Ajuga reptans*), and coral bells (*Heuchera sanguinea*) in bloom.

Below, border jewel (*Polygonum affine*) and wooly thyme (*Thymus pseudolanuginosus*) serve as an erosion controlling ground cover that also smells good when walked upon. Austrian pine (*Pinus nigra*) makes for a stately guide along the walk to the front entry.



Diane Ives

tus, provides a candelabrum quality and blooms yellow in late summer. You can also make use of variegated, silver and colored foliage, with finely cut patterns against bold, solid backgrounds. Mix vegetables and other edibles with decoratives. Try an English attitude. In a cottage garden nothing is improper.

After all of your adjustments and your horticultural experiments, you may want to include some of the old cottage favorites.

Plants that require less water

Bulbs:
- Daffodils, *Narcissus* spp.
- Tulips, *Tulipa* spp. and cvs.
- Ornamental onion, *Allium* spp.

Windflower, *Anemone* spp.
Sweet pea, *Lathrys latifolius*
Hollyhock, *Alcea rosea*
Bearded iris, *Iris x germanica*
Cottage pink, *Dianthus plumarius*
Cranesbill, *Geranium* spp.
Borage, *Borago officinalis*
Michaelmas daisy, *Aster novae-angliae*
Lavender, *Lavandula angustifolia*

Plants which make great substitutes for original cottage plants

Foxglove, *Digitalis lanata*
Evening primrose, *Oenothera caespitosa*
Lupine, *Lupinus argenteus*
Daylily, *Hemerocallis* cvs.
Bluebell, *Campanula rotundifolia*
Cornflower, *Centaurea montana*
Wild rose, *Rosa woodsii*
Clematis, *Clematis orientalis*

Natives or well adapted exotics that belong in the dry cottage garden

Blue flax, *Linum perenne* subsp. *lewisii*
Perennial sage, *Artemisia* spp.
Oriental poppy, *Papaver orientale*
Beebalm, *Monarda fistulosa*
Turtle's head, *Physostegia virginiana*
Blanket flower, *Gaillardia artistata*
Prairie coneflower, *Ratibida columnifera*
Russian sage, *Perovskia atriplicifolia*
Purple coneflower, *Echinacea purpurea*
Prairie zinnia, *Zinnia grandiflora*
Spiderwort, *Tradescantia occidentalis*
California fuchsia, *Zauschneria californica*
Gayfeather, *Liatris punctata*

Annuals that require little water

Cosmos, *Cosmos* cvs.
Nasturtium, *Tropaeolum majus*
California poppy, *Eschscholzia californica*
Strawflower, *Helichrysum bracteatum*
Flowering tobacco, *Nicotiana alata*
Rock rose, *Portulaca grandiflora*
Statice, *Limonium* spp. and cvs.
Spider flower, *Cleome hasslerana*
Blackfoot Daisy, *Melampodium leucanthum*
Love-in-a-mist, *Nigella damascena*

Fruits, grains, vegetables and herbs that do not need as much water as a bluegrass lawn include

Apple, *Malus sylvestris*
Sour cherry, *Prunus cerasus*
Wild strawberry, *Fragaria vesca*
Amaranth, *Amaranthus* spp.
Dry beans, *Phaseolus* spp.
Sunflower, *Helianthus* spp.
Cucumber, *Cucumis sativus*
Muskmelon, *Cucumis melo*
Okra, *Abelmoschus esculentus*
Squash, *Curcurbita* cvs.
Tomato, *Lycopersicon* cvs.
Watermelon, *Citrullus* cvs.
Dill, *Anethum graveolens*
Onion, *Allium* spp.
Oregano, Origanum vulgare
Sorrel, *Rumex* spp.
Basil, *Ocimum* spp.
Parsley, *Petroselinum crispum*
Sage, *Salvia* spp.

Favorite Water-Wise Trees & Shrubs

Larry E. Watson

Shade Trees

Shade trees are the backbone of a landscape, and should come first when you think of any new planting. Think about shade trees as those plants in the landscape that you walk under like an outdoor ceiling. They will take the longest time to develop and will usually consume a large part of your landscape budget. When properly selected and placed, the value of these trees will increase year after year. If you make a mistake, it will cost a lot more to have them moved or removed than it does to purchase them in the first place. Extra dollars spent on the right tree initially will be rewarded years later.

Selecting trees for a water-wise landscape presents a challenge in our Rocky Mountain environment. Drive outside of urban areas and you will observe that the High Plains landscapes of lower elevations do not support many tree species. Basically, the only places we see trees growing are in areas where there is extra water: water courses, ponds and arroyos. This should give some direction to the kinds of trees you will want to select, and what you will have to do to make them prosper in your landscape.

Remember, nearly all newly placed plants must receive additional water in order to become established, which takes three to four years. When you attempt to create a landscape with little additional water, consider these four trees.

Bur oaks (*Quercus macrocarpa*) are native to North America. However they do not occur naturally as far west as Colorado. The bur oak is a stately tree growing 80 to 100 feet. It is often listed as being slow-growing but this is not always a detriment.

The tree exhibits a deeply furrowed bark and very corky young branches. It is tolerant of many different soil conditions and of urban atmospheres. Its large leaves are dark green in summer and turn yellow or yellow-brown in the fall.

English oaks (*Quercus robur*) were introduced to the United States in the late 1700s. The first of this species were probably brought to Colorado in 1890. The English oak is a round-headed tree growing 60 to 80 feet. Its leaves are small (2" to 6" long and 1" to 3" wide), dark green and frequently persisting into the winter. When falls are long, the leaves will turn yellow, but usually they freeze and turn brown. Some reference books list the foliage as being susceptible to powdery mildew, rarely a problem in our dry climate.

There are named selections of this species. The most common is the fastigiate or very narrow form. This form will eventually be 10 to 15 feet wide. It can be grown with branches to the ground or with its branches pruned up. Another selection is *Quercus robur* 'Pyramich' or skymaster English oak. This has an excellent pyramidal form.

Kentucky coffee trees (*Gymnocladus dioica*) are natives of the eastern and central United States. Like the English oak, the Kentucky coffee tree is listed as hardy in zone 4.

The coffee tree is an open, stark looking tree in the winter. In the summer it has a

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lush, almost tropical appearance. Its leaves are doubly compound and are bright green in summer. In the fall the foliage turns golden yellow. One advantage of this tree is that it gives nice filtered shade in the summer, but will allow a lot of sun into your yard in the winter. Coffee trees have pinkish flowers in late spring. These are later replaced by fat, dark-brown seed pods, which stay on the tree well into winter. This interesting tree does not have much "sales appeal" when young, but is a tree that "just gets better each year."

Hackberry (*Celtis occidentalis*) is another tree native to the northern United States, listed as hardy to zone 2. Although this tree is always listed as drought-tolerant (which is true), it will also live in very wet soil (it must, however, be well-drained). Hackberries will increase in size in proportion to the amount of water they receive. The foliage is a medium green in the summer and a bright yellow in the fall. It is another tree that does not have much sales appeal when it is young, but grows more beautiful each year.

Shrubs

As trees are the ceiling of a landscape, shrubs are the walls. Shrubs are used as screens or for dividing spaces. Normally, for a screen you will need plants that grow taller than eye level. To divide your landscape into areas, you may wish to use smaller shrubs.

One general observation is that almost all shrubs will grow as wide as they do tall. Another general rule is: When you are using the same kind of shrub, you will want to place the plants close together. With different types, they should be spaced farther apart.

Here are some of my favorite shrubs, which will live with very little additional water after they are established.

Curlleaf mountain mahogany (*Cercocarpus ledifolius*) is native to Utah and Colorado. This large shrub has many interesting features, but its evergreen foliage is one of the best. This plant has grey bark and small very dark green leaves. Curlleaf mountain mahogany will grow to 30 feet, although I have never seen one much larger than 15 feet. It could be trimmed into a very fine small tree and responds very nicely to training. Therefore, it could be made into a nice hedge as well.

New Mexican privet (*Forestiera neomexicana*) is native in Southwestern Colorado and New Mexico, where landscapers trim this plant to form a small tree. It has yellow flowers in spring before its bright green leaves appear. *Forestiera* grows very dense and is quite twiggy, so that even in the winter it does a great job of screening.

Threeleaf sumac (*Rhus trilobata*) is a 4' to 5' shrub that can be used as a specimen or as a medium-sized divider. If given enough space this plant will spread wider than its 4' to 5' height, but it can be pruned to fit a smaller space if necessary.

Threeleaf sumac has yellow flowers in the spring before the leaves appear. These flowers then form hairy red fruit which last late into the winter. The three-lobed, dark, shiny green leaves turn a rich red or mahogany color in the fall. Reportedly, some people receive a skin rash from working with this plant.

Red-leaf rose (*Rosa rubrifolia*) is one of my favorite shrub roses. Usually seen as a 4' to 5' plant, it may grow to 10' tall in favorable locations. The foliage is purple-red, fading to reddish green in the summer or in shade; its best color is in full sun. Its single, pink flowers are followed in summer by bright orange rose hips that stay on the plant almost all winter. In the fall it puts on a brilliant display of yellow-orange foliage.

When landscaping with little additional water the shrub list can be much larger than the tree list. This is only a small sampling of my favorites.

Diane Ipsen

Left, hackberry (*Celtis occidentalis*) clothed in autumn yellow
Below, Red-leaf rose (*Rosa rubrifolia*) in bloom

Right, threeleaf sumac

Lawns & Water Conservation

Dorothy Borland

Now that we are becoming increasingly aware of water use in our landscapes, our first thoughts for saving water in our semi-arid climate are directed toward our lawns. Generally, a lawn is the largest plant grouping in a landscape, the one requiring the highest degree of maintenance and—to keep it green—water.

Nevertheless, when we consider our lawns as high-water-using and high maintenance creatures, we must also remember the additional benefits that these turf areas provide.

It has been shown that lawns help reduce soil erosion and pesticide leaching, stabilize dust, cool the surrounding air, reduce runoff from rain and help replenish groundwater. Lawns also provide a pleasant area to rest and play.

However, to reap these benefits—and still conserve water—consider carefully during the design process where you will plant your lawn to get the most benefit. Place your lawn area where it will be used the most, or where it will receive runoff from other areas.

The most commonly used turf in Colorado is Kentucky bluegrass. Because of its ability to produce a dense lawn, it is considered the premier lawn grass. The newer varieties of Kentucky bluegrass are dark green and fine-leaved. A cool season grass that spreads by underground rhizomes, it grows best with high levels of water, mowing and fertilization.

Bluegrass can be a good lower maintenance turfgrass *if* we water and maintain it wisely. Also, it wears well and recuperates from damage fairly readily because of its rhizomatous growth habit. Although its disease resistance has been improved with additional plant breeding, bluegrass can suffer from disfiguring diseases which are generally related to improper maintenance such as irregular or over-watering and over-fertilizing.

Just as we have many options for our landscapes in the kinds of trees, shrubs and flowers from which to choose, now we have alternatives to bluegrass. But it is important to understand why you want to change your lawn and how you want it to appear. Each alternative grass will produce a different appearance, just as different species and varieties of trees have different flower color, growth habit or leaf color.

The next most commonly used turfgrass is tall fescue. The newer cultivars have leaf blades that are as fine as bluegrass and are commonly called "turf-type tall fescue" to distinguish them from the older, wide-leaved pasture fescues.

Tall fescue, like bluegrass, is a cool season grass but, unlike bluegrass, it is a bunchgrass. It has very good shade tolerance, better salt tolerance than bluegrass and good wear tolerance. Also, it germinates faster and establishes more quickly than bluegrass.

For most uses, this is quite an acceptable turfgrass. Its appearance, an issue often raised with alternative turfgrasses, is so similar to bluegrass that most people cannot tell the difference between the two when grown on opposite sides of a sidewalk. The newer

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cultivars are "barefootable," an attribute not true with the older cultivars.

It is estimated that tall fescue produces an attractive turf with approximately 20 percent less applied irrigation than bluegrass requires.

For warm season grass enthusiasts, the native buffalo grass is the favored choice. It spreads by stolons, (shoots that grow like strawberry plants) forming a dense sod that rarely grows any taller than six inches. This

Turfgrass Options:

Grass	**Characteristics**	**Special Features**
Kentucky bluegrass, *Poa pratensis*	C,S,I	Familiar lawn grass that spreads by rhizomes; good cold and wear tolerance; requires approximately 1½″ moisture/week during hot season (35″/season).
Perennial ryegrass, *Lolium perenne*	C,B,I	Often included in mixes with bluegrass; quick germination; good shade and disease tolerance; maintenance needs similar to bluegrass.
Buffalo grass, *Buchloe dactyloides*	W,S,N	Spreads by stolons; turns tan in fall; greens up three weeks after bluegrass; rapid germination with treated seed; mowing optional as normal height is 6″ or less; adapted to 15" to 25″ annual moisture; poor shade tolerance; excellent heat and drought tolerance.
Blue grama, *Bouteloua gracilis*	W,B,N	Generally found with buffalograss; excellent heat and drought tolerance; poor shade tolerance; adapted to 12" to 25″ annual moisture; normal foliage height 8 - 12″.
Smooth brome, *Bromus inermis*	C,S,I	Pasture grass now being used in turf settings; leaves 1/4" to 1/2″ wide; seasonal water requirement approximately 18″.
Tall fescue, *Festuca elatior*	C,B,I	Improved varieties planted in pure stands; improved varieties have fine texture similar to bluegrass; good drought tolerance with deep root system; approximately 28″ annual water requirement.
Wheatgrasses	**Characteristics**	**Special Features**
Desert/Siberian, *Agropyron sibiricum*	C,B,I	Excellent drought tolerance; goes dormant under heat and drought stress; good cold tolerance; tolerate a 3" to 4″ mowing height; produces a better turf appearance; leaves about 1/4″ wide; adapted to 12" to 20″ annual moisture.
Western, *Agropyron smithii*	C,S,N	Bluish foliage; can be an aggressive spreader; good drought and cold tolerance; adapted to 14" to 25″ annual moisture.

KEY:
C = cool season; W = warm season grass; B = bunch grass,
S = sod-forming grass, I = introduced species; N = native species

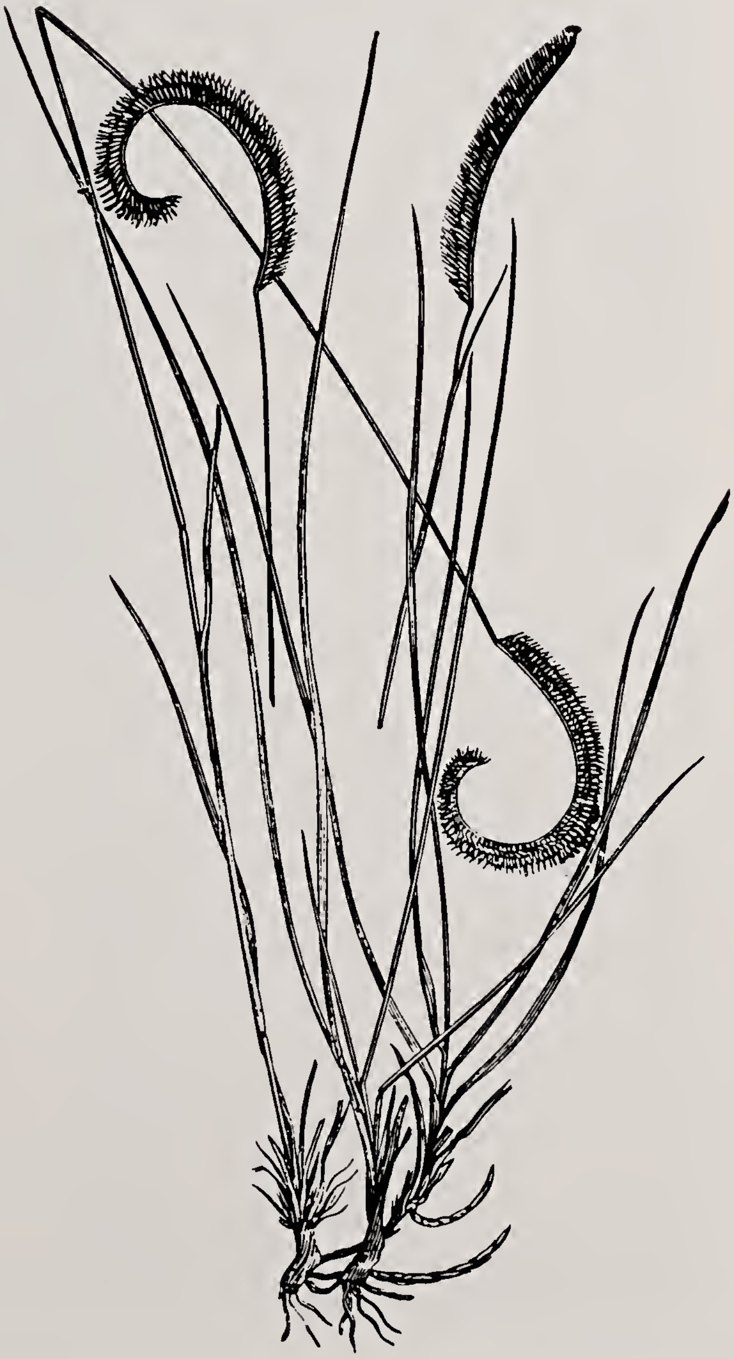
feature can reduce the necessity for mowing to as seldom as once or twice a year.

Sometimes blue grama, another native warm season grass, is mixed with buffalo grass. Blue grama is a taller bunchgrass with slightly wider leaves than buffalo grass. It can be added to a buffalo grass mix for diversity, to reduce the cost of seeding, or to replicate the natural mix found on the prairies.

Because these two grasses are both warm season grasses, they go dormant and off-color in the fall with the advent of shorter days and cooler temperatures. They usually don't green up again until mid-May, depending on the spring temperatures and weather. The dormant color is a very even tan, compared to the mottled green and brown colors of cool season grasses during the winter.

Local turf farms have responded to the demand for sod of alternative grasses and now offer tall fescue sod. It can be purchased either as a pure stand and grown with netting to hold the sod together, or as a mixture with bluegrass. If the percentage of bluegrass on a seeded weight basis exceeds 10 percent, the sod you purchase will likely be over 50 percent bluegrass. Buffalo grass will be available as sod in spring 1993 and also from a few nurseries as plugs that are planted like annuals, but grow perennially.

At this time these are the most likely choices for turfgrasses. Crested wheatgrass has been promoted occasionally as a turfgrass, but, in my experience and at Colorado State University, this grass has not performed well, even with heavy irrigation. There is considerable research and breeding being performed on additional grasses for more specialized uses.



Making the Switch ... A Personal Story

Sandy Snyder

Residents of hot, dry areas like eastern Colorado are becoming very interested in warm season grasses. The question comes up, "What is the best way to convert a lawn of cool season grass, such as Kentucky bluegrass, to warm season grasses such as buffalo grass or blue grama?"

The warm season grasses require less water, fertilizer and mowing. If you have a large open area that does not get much traffic, native grasses will give you an acceptable suburban lawn. And small, difficult-to-maintain, open, sunny areas such as parking strips, cul-de-sacs and south-facing slopes are also good candidates for warm season grasses. These grasses thrive in hot, dry locations and seem to enjoy being planted between reflective surfaces.

An excellent warm season turf is buffalo grass (*Buchloe dactyloides*). It is dioecious, meaning that the male and female flowers are on separate plants. The male flowers look like small wheat heads if they are allowed to grow to their full height, 4" to 6". I like these little flowers because they make my grass area more interesting with texture. Others prefer planting only the female grass because it has a less ragged appearance when it is allowed to grow long. The female plants' seed heads are not readily visible because they snuggle down around the crown and can be found only if you are looking for them.

Blue grama, (*Bouteloua gracilis*) is a warm season grass that I like very much because it sports a cute "eyelash" seedhead atop its wiry stem. It is a clump grass but it can be broadcast-seeded and treated as turf. There is a broadcast area of blue grama grass planted in the Xeriscape Demonstration Garden at the Denver Botanic Gardens. You're invited to see if you could live with it as part of your home landscape.

Keep in mind that most home lawns have several areas. The different areas do not have to be planted with the same kind of grass. Different sections of your yard can be planted with grasses that will do the best in each area.

I have converted my own suburban Kentucky bluegrass lawn to buffalo grass three different ways. Ten years ago in May and June I had an open area that I tilled and seeded with 'Sharp's Improved' buffalo grass seed. I cared for the newly seeded lawn the same as for newly seeded bluegrass. I kept it damp and the seed sprouted in ten days.

During the summer weeds grew faster than the new grass. I felt that I could not apply chemical weed killer to the young grass blades, so I hand-weeded the large area four times to keep the weeds from crowding out the new grass. This was not much fun. I don't think I will seed a buffalo grass lawn again.

I have since discovered that two inch pre-rooted plugs work better. Pre-rooted plugs are grown from seed in pots or aeration-like plugs of grass that are pulled from a sod area, put into pots, watered and fed to develop new roots.

Last year I graded an open soil area and hand planted two-inch plugs in early July. I neglected, however, to apply a pre-emergent herbicide. Purslane quickly appeared and had to be hand-weeded at least once a week during

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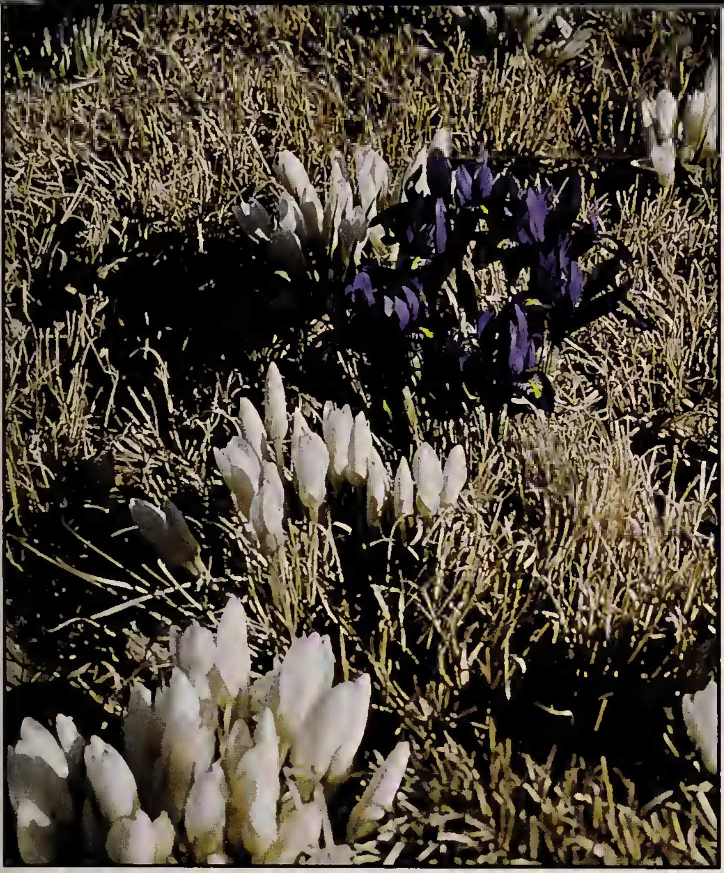
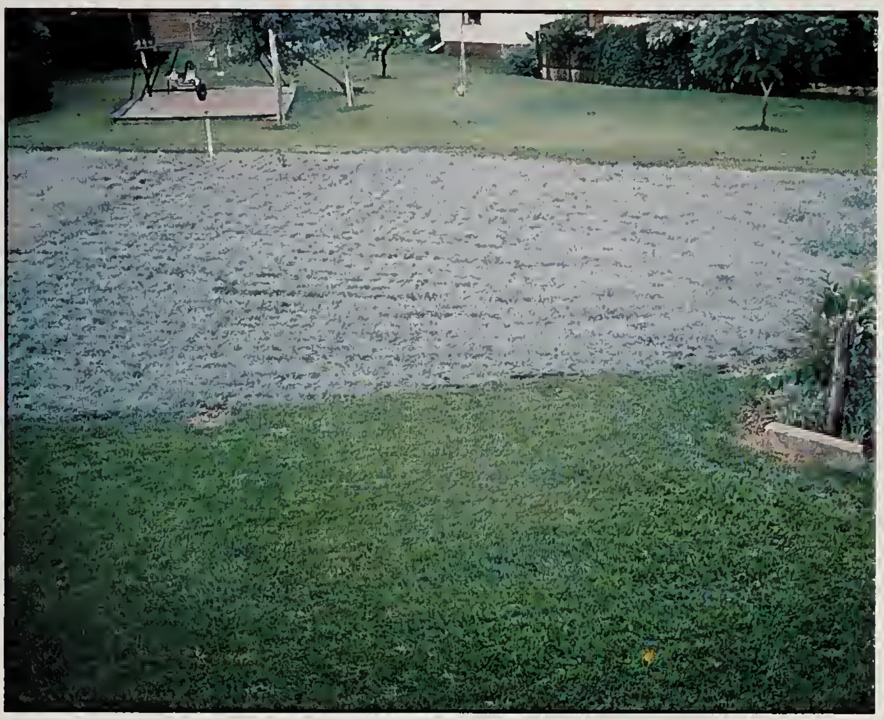
Sandy Snyder, rock alpine gardener at DBG, lives in Littleton where she maintains an extensive, xeriscaped home garden.



Sandy Snyder



Above left, *Iris reticulata* and *Crocus chrysanthus* 'Snow Bunting' appear before the buffalo grass comes out of dormancy.

Above right, recently plugged buffalo grass lawn in area previously covered by Kentucky bluegrass. Notice the color difference between the two species.

Left, Xeriscape Demonstration Garden at the Denver Botanic Gardens showing mowed and unmowed blue grama

Bulbs and Corms in the Grass!

Species and variety	Flower color	Season of Bloom
Crocus ancyrensis 'Golden Bunch'	Yellow	Mid- to late Feb., last a month.
C. chrysanthus 'Princess Beatrix'	Blue-white	Late Feb. to mid-March, last a month.
C. chrysanthus 'Snow Bunting'	White	Late Feb. to mid-March, last a month.
C. sieberi 'Firefly'	Lilac	Late Feb., continue into March.
Galanthus elwesii	White	Jan. or Feb., continue into March.
Iris reticulata 'Harmony'	Deep blue	March, last almost a full month.
I. reticulata 'J.S. Dijt'	Dark purple	March, last almost a full month.
Narcissus asturiensis	Yellow	Early to late March, last a short time.
Tulipa humilus	Rose	Mid- to late April, last two weeks.
T. kolpakowskiana	Yellow	Mid- to late April, last two weeks.
T. linifolia	Red	Mid- to late April, last two weeks.
T. tarda	Yellow-white	Late April, last two weeks.
T. urumiensis	Yellow	Mid- to late April, last two weeks.

the first part of the summer until the plugs filled in the area.

My most successful renovation was seven hundred square feet of healthy Kentucky bluegrass lawn that I converted to buffalo grass. I started killing the bluegrass with a glyphosate-based herbicide in the fall. The following spring I finished killing it. It took four applications, in all. I did not, however, remove the dead sod.

I had contracted with a friend to have buffalo grass plugs grown in 2 1/4" pots which were ready in July. These were healthy, robust plugs that were not root-bound. If the plugs are root-bound the roots must be loosened before planting, otherwise the plug will just sit in the ground and fail to grow outside of the rooted boundary.

We planted the 2" plugs 8" on center. This was too close, but I wanted to make sure the lawn filled in within one growing season. The two-inch plugs took hold very quickly, and because they were placed in the dead bluegrass sod there was no open soil to encourage weeds. As the plugs were filling in during the summer, only three large mallow weeds grew. I hand-pulled them, easily.

Buffalo grass does well with little water but it will also adapt to moderate water levels. The trick is to give it enough water to thrive and grow quickly, but not so much that weeds and bluegrass will settle and compete. Planting a buffalo grass lawn is a do-it-yourself project. The seed is available but not in every garden center.

Plugging is very successful but machines that plug a large area or convert small areas are not readily available. We had to design our own tool to plug buffalo grass into the dead sod: four blocks of wood shaped like a 2 1/4" pot placed in the corners of a 12" square of plywood with a broom stick for a handle. We watered the ground so it would be soft but not mucky, then stepped on the plywood square to make the holes. This compacted the soil but it worked anyway. I don't think a commercial grass installer would put up with this primitive tool. It was slow and would be too exhausting to use on more than one lawn. If a small aerator type machine could be fitted to pull the correct size plugs I think that would work beautifully.

The disadvantage of buffalo grass is the high cost of seed, but this can be defrayed over the years as you save on water and maintenance. Its light green color is not noticeable when it is not growing beside bluegrass.

I think the longer dormant period of buffalo grass is very advantageous, because it provides a time when bulbs can explode with color on the beige canvas that this grass provides. I chose small species bulbs that have narrow leaves and bloom early throughout the spring to give color to my buffalo grass lawn.

I am very satisfied with my buffalo grass lawn because it now saves me time, work, water and money. I love my buffalo grass bulb garden because every spring it inspires an excitement around our house that even the best manicured “ordinary” lawn could not match.

A Prairie for Your Thoughts

Rick Brune

When the first pioneers homesteaded in eastern Colorado they began to radically change our prairie ecosystem—an ecosystem that had evolved over thousands of years into a landscape perfect for our semi-arid climate. Prairie gardens allow us to adopt parts of that ecosystem for our home landscapes. They also allow a fresh look at the wealth of beautifully adapted plants our prairies offer.

Using prairie as a landscape element provides savings in water, fertilizer, mowing and weed control. As with any other type of garden, it isn't accomplished without work, but other expenses are relatively low. No expensive irrigation system is needed. The lawn mower will be used perhaps once a year. And after the first year or two, your prairie garden will survive with minimal attention.

More importantly, it will give you a new appreciation of Colorado east of the foothills. You will enjoy the delicate fragrance of evening-blooming plants such as scarlet gaura (*Gaura coccinea*). Your neighbors may comment on the gardenia-like scent of sand verbena (*Abronia fragrans*) permeating the night air. Spectacular night bloomers like giant evening star (*Mentzelia decapetala*) and evening primroses (*Oenothera* spp.) can also be enjoyed, without a camping trip to the prairie.

Of course, most prairie wildflowers are day bloomers. But when I began prairie gardening, I had no idea how much exploring with a flashlight I would do! You may spend significant time sitting by plants in the evening as their flowers unfurl before your eyes.

Although some of the common flowers are available commercially, you may have to propagate many yourself. That's part of the fun and education of prairie plants. Although we've used and abused the prairie for over a century, we know little about how species are propagated or other aspects of their life histories. Simple backyard observations can provide new discoveries.

What type of prairie is adaptable to the home landscape? Eastern Colorado evolved with over twenty different kinds. Given the rather conservative attitudes about landscaping in Colorado and ordinances governing the height of unmowed grass, a form of shortgrass prairie is the best starting point. Rest assured it will not look like the overgrazed putting green found in parts of eastern Colorado.

A shortgrass prairie garden is only one imaginative step from planting a buffalo grass (*Buchloe dactyloides*) lawn. Did I hear someone say they didn't want their yard to turn brown in winter?! A prairie garden with a mixture of buffalo grass, blue grama (*Bouteloua gracilis*), sideoats grama (*B. curtipendula*) and perhaps other grasses doesn't just turn brown. It becomes a delightful mix of warm shades of yellow, bronze and gold. It's an infinitely cheerier aspect of winter than a dingy bluegrass lawn.

Why do we plant a prairie garden? Why not plant one of the canned wildflower mixes

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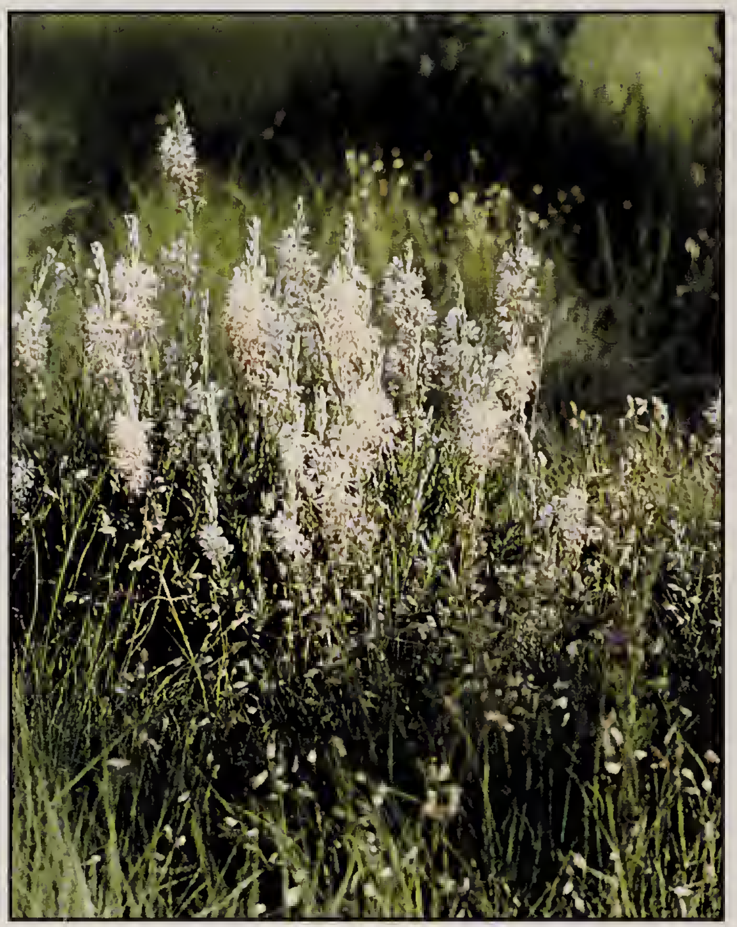
Rick Brune is a botanical consultant. He leads prairie field trips and teaches prairie gardening. He wrote a 15-page guide to prairie gardening, *The Prairie Garden*, published by the Colorado Native Plant Society. This step-by-step guide to creating a shortgrass prairie garden is available for $3 at local chapter meetings or from the Denver Botanic Gardens Gift Shop.

or install sod and be done? Plant a "wildflower" mix and you'll get everything from California poppies and cornflowers to blue flax and field clover. This, however, is not a prairie. Reading the labels of mixes will usually show that very few indigenous or genuine wildflowers are in them. "Native" species may be native to other parts of the country, not to Colorado. Even if you find genus and species on the label native to Colorado, it may not be genetically adapted to our semi-arid prairie climate or droughts.

There are no shortcuts to a prairie garden. But success will mean a delightful and educational garden to explore, and also the opportunity to educate others about the use of prairie flora in the landscape.


Rick Brune

Above left, *Guara coccinea*

Above right, shortgrass prairie garden

Right, a view along the West boundary ot the Denver Botanic Gardens' Laura Smith Porter Plains Garden

Left, Shortgrass prairie garden, *Ratibida columnifera*

Below, mid and short grasses in the Laura Smith Porter Plains Garden

How To Water a Lawn

Marcia Tatroe

Okay, you've added organic matter to your soil, you've chosen the best turf for your location, you're following a sensible regimen for fertilizing, weed control and aeration. So, now you just add water and—presto—a beautiful lawn. Well ... no, it's not quite that simple, especially if you don't have an automatic irrigation system.

Turf that is not getting enough water loses its vigor and becomes prone to insect damage, diseases and weak, thin growth. Weeds then move in to compete with grass roots for any available moisture. Thinning also leaves soil surfaces exposed and results in increased evaporation, loss of soil moisture and erosion.

On the other hand, too much water can lead to a swamp-like environment, especially in low spots on heavy, poorly drained clay. Water fills in all of the air spaces in the soil and the grass roots are left "gasping" for air. Ideally, soils should contain equal amounts of water and air for best root growth.

Overwatering also leaches nutrients from the soil, creating an increased demand for costly fertilizer. Additionally, water draining from lawns collects in sewers, providing ideal breeding sites for mosquitoes, and problems with water quality. Run-off also undermines sidewalks and roadways, adding greatly to the cost of their repair and upkeep.

How do you decide when to water and how much? The trick is to strike a balance, allowing the soil to dry partially between waterings but watering before the grass shows signs of stress.

Different grass types have different water needs. Native buffalo grass and blue grama will survive without irrigation after they're established. Tall fescue and bluegrass turfs need approximately 1" to 2" of water per week during hot, dry weather. The first irrigation of the year should be held off until May to encourage the grass roots to grow deeply in search of sub-soil moisture.

Many environmental factors can affect a lawn's need for water. Grass that is sheltered from drying winds and intense sunlight will usually need less water than lawn on exposed, south-facing sites. But if trees are providing this shade, their roots will compete with the grass for moisture and nutrients.

It's also important to know your soil type. Sandy soils allow water to penetrate very fast and deep, but dry out quickly. Our more common clay soils hold water very well, but absorb it slowly and are terribly prone to puddling and run-off problems. For both soils, water may need to be applied in short repeated intervals for water infiltration that benefits the turf and not the aquifer or the gutter.

Reflected heat from sidewalks or structures, extremely high temperatures, heavy foot traffic, mowing height under 2 1/2", overfertilizing, insect pests, disease and thatch can all increase a lawn's need for water.

The best way to decide when to water is to regularly monitor soil moisture and to water only when the soil begins to dry out. A simple gauge is a soil coring tube that pulls a plug of sod and soil which allows you to see

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Marcia Tatroe is a master gardener for Arapahoe County, volunteer in the Denver Botanic Gardens' Rock Alpine Garden, and chairs the xeriscape division of Denver Botanic Gardens annual plant sale.

and feel the moisture—or use a screwdriver. It will push into the soil easily only to the depth that the soil is moist. Or several times a season, 24 hours after watering, dig out a one foot square of turf and examine the soil and root depth (you can then replace it without damage to the lawn). Check the depth the water has penetrated. The soil should not be soggy. The water should have penetrated 8" to 12"; ideally this is about 2" below the root zone.

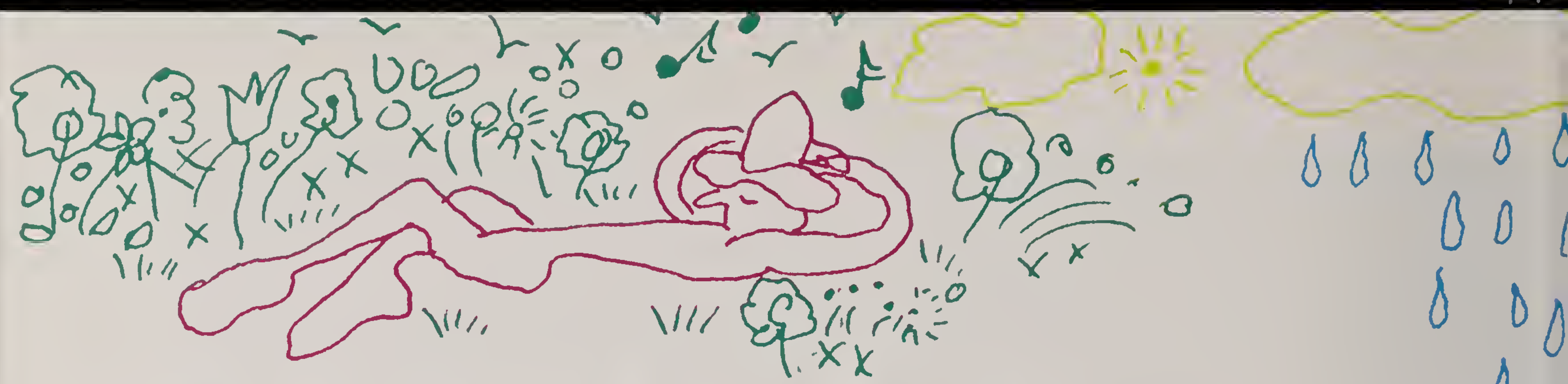
Rainfall should be measured and subtracted from the lawn's weekly water requirement. A rain gauge is a simple device available from most garden centers. A vertical-sided food container will also suffice. Measure the depth of accumulated rain water in the container with a ruler. Keep in mind that a light sprinkle will quickly evaporate from the lawn and that a real gully-washer may run off before it has time to soak in.

To check the water output and distribution of your sprinkler, place a dozen vertical-sided containers (all containers should be the same size and shape) in parallel rows extending from the sprinkler. One row should be placed next to the line of sprinkler heads, another at the outer reach of the heads and a third directly between the two. Set the sprinkler system to run for a 15 minute period of time and then measure the water in each container. Compare applications in each can before you determine the average amount of water applied. Then figure out how long it takes to apply one inch of water. This will indicate whether the sprinkler pattern is uneven and where it will be necessary to compensate by enlarging or overlapping the spray patterns. Be sure to check the water output at the same time of the day that you plan to use the sprinkler as water pressure can vary greatly at different times of the day.

The best time to water is from 1 to 6 a.m., when winds are quiet and evaporation is low. Use a sprinkler head or unit that throws large water drops low to the ground to reduce drift and evaporation. Even in clay soils that are properly amended, water may run off before it has a chance to soak in. If this is a problem, water in cycles: for example, 15 minutes on, 30 minutes off, and repeat the cycle, experimenting until you find the right combination that works. Whatever you do, don't forget to turn the sprinkler off. You can buy an inexpensive faucet timer to do the job for you, or you might use a timer as a reminder.

Come winter, you may welcome a break from lawn care, but just because the lawn is dormant, doesn't mean it's without a need for water. In dry winters the lawn will benefit from one inch of water once a month. Choose a warm, windless day and water early enough in the day so that the water will have a chance to soak in before the soil freezes at night. Be sure to pay particular attention to slopes, especially on south- or west-facing exposures.

You'll be handsomely repaid for the few hours it takes to become familiar with your lawn's water needs. You'll reap savings on your water bills and have a much healthier lawn.



The No Front Lawn Front Lawn

Chet Grabowski

The times sure are changin'
    and people are changin' too,
the ways they approach the lives they lead,
    and their environmental attitudes.

We've all got to know our place in this world,
    and deal with troubles on our own,
so my contribution to the fate of the planet
    will be to eliminate my front lawn.

Now I ain't got that much against
    a nice front lawn you see,
'cept you've got to aerate it and fertilize it,
    and rake it to keep it neat.

Then, you've got to move 'round all those hoses
    to keep the edges lookin' fine,
to say nothing of all the cutting it takes
    in the middle of summertime.

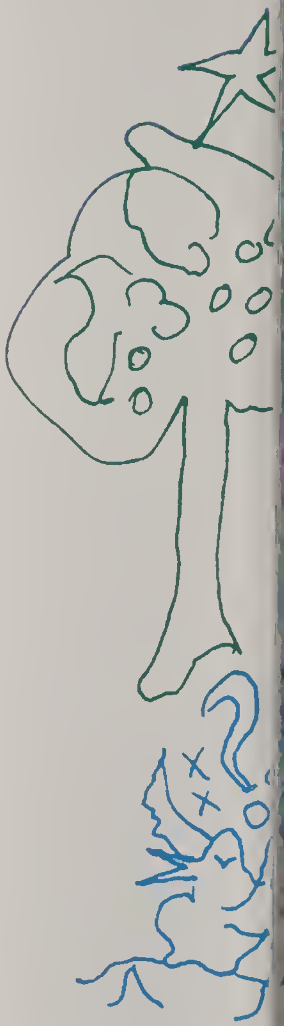
And after you've completed all that work
    and managed to keep the weeds at bay,
you've used up half the water in the reservoirs.
    What's it good for anyway?

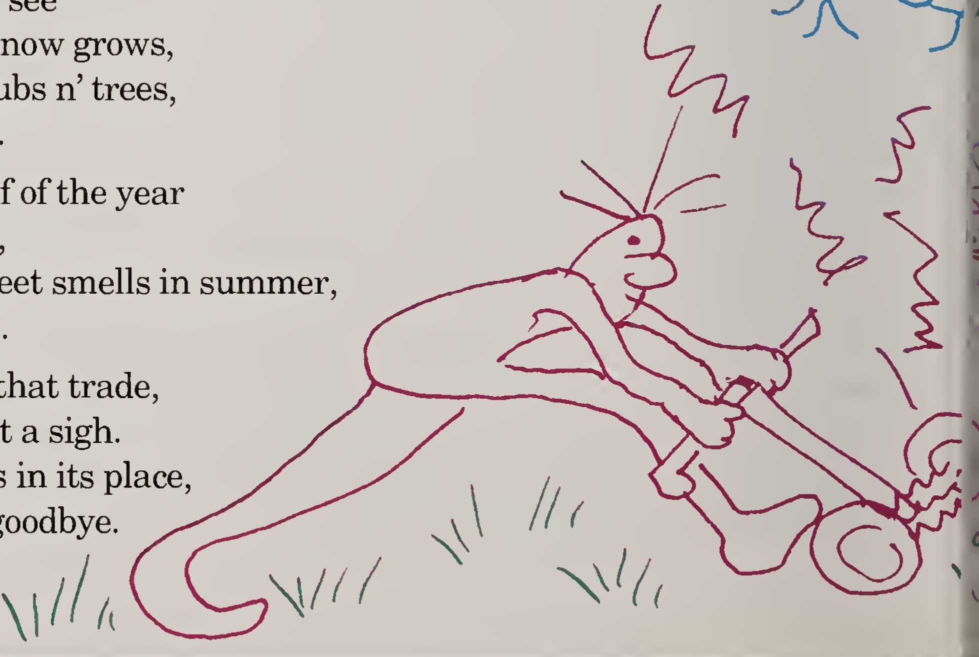
Well, I'm still one of those who likes to wet their toes
    in the dew on a new summer day,
and dash across naked in the full moonlight,
    or play a friendly game of cutthroat croquet.

But speakin' just for me, I'd rather see
    pretty flowers where my lawn now grows,
and native plants n' grasses n' shrubs n' trees,
    that put on a continuous show.

Instead of manicured green for half of the year
    and brown the rest of the time,
I'd have bright colors in spring, sweet smells in summer,
    and texture for the wintertime.

So all things considered, I'll make that trade,
    and bid my lawn adieu without a sigh.
That being the case, I'll put flowers in its place,
    and you can kiss my grass … goodbye.





No Maintenence?

Pat Montane

One of my favorite clients started our interaction by pleading for a no-maintenance landscape. At the time he had two-plus acres hip deep in thistles, clover and bindweed. "There isn't such a thing," I retorted, "even if you cover the whole lot with weed barrier fabric and gravel". If you agree with the need for maintenance in any landscape, congratulations, you have just invested in the value of your home!

You have a great degree of control over the amount of maintenance that a landscape will require. It begins with good design or renovation layout where the landscape has been divided into water-use zones, as mentioned in other articles. This includes the consolidation of high-maintenance (usually high-water also) plantings such as perennial and vegetable beds and lawn areas into easily accessed zones, choosing plants that "fit" those zones and planting shrubs and groundcovers so they will grow to cover the soil completely within a three year period. If you choose plantings that require irrigation, all of the details outlined in the irrigation articles within will also be helpful. And, depending upon the plant material you choose, you will most likely want to prepare your soil when installing plants or improve it over time. Mulching can help reduce maintenance as suggested in other articles. These techniques, and others that follow, will also reduce the amount of water used or wasted in your landscape.

But first let's examine some important considerations. Do you want or need the assistance from a professional landscape service or can you get by on your own? There's obviously a financial trade-off here, but you may also want to consider how much horticultural knowledge you have. The world of horticulture has disproved many a "wive's tale" and some practices work well on the East or West coast but are very different in the Rocky Mountains. Do you have access to the right tools? And most important of all, do you have the time and energy to commit to your landscape? Newly installed landscapes will require more maintenance during the first three years than a mature landscape, primarily because new plantings must be weaned of water slowly, and disturbed soils are more likely to host weeds.

The most important point, however, is that you enjoy your landscape! If you are spending more time pulling weeds than you are sitting in the sun or strolling through your garden, consider having a professional do the work.

Lawn Care On Your Own

Maintenance for established bluegrass lawns includes watering two times or, at most, three times a week. Other grasses will usually require less water than bluegrass, but only if the soil has been appropriately prepared. This is especially true of tall fescue lawns. You can tell when any grass is water-stressed if foot prints remain after walking across your lawn, or if it develops a dull, blue-grey color.

Do you have thatch? This is an accumulation of living and dead plant matter on the soil surface below the greenery of your lawn.

Pat Montane is a hobby gardener and naturalist residing in Silt, Colorado.

If it's deeper than 1/2", your waterings may be running off the surface of the thatch, rather than penetrating the soil. And of course, deep thatch is a great place where bugs and disease will make their homes. Thatch can be a benefit, however, because it serves as mulch. It also tells you how healthy your soil is. Compacted soils usually develop thatch problems.

Thatch and many other lawn problems can be reduced with one to two aerations per season, in the spring and early fall, and especially in areas that are used heavily. Aeration is the pulling of soil plugs, or introduction of slits into your lawn. It is the next best thing to actually tearing out your lawn and starting over to incorporate air into the soil. Following a top dressing of 1/2" layer of a fine grade organic matter and fertilizer, aerations will make your lawn noticeably healthier over time.

Mowing to a height of 3" during warm months, and to 2" during cooler months will enhance the establishment of deeper roots, which makes for increased drought tolerance. Consider leaving your grass clipping on the lawn as this returns nutrients to the soil and maintains a consistent thatch reservoir for soil microorganisms to "eat," a long term benefit to the overall health of any soil. If your clippings are piling up you may be watering or fertilizing too much, not mowing often enough, or a combination of all three. There are numerous fertilization recommendations available. Follow the one that suits you, but remember that over-fertilization will force you to water and mow more often.

Finally, a sharp mower blade will also reduce water loss through ragged leaves that have otherwise been flailed by an unsharpened blade. A ragged lawn is susceptible to more disease as well.

Maintaining Established Trees & Shrubs

Plants that are bug infested or diseased are indicators that we are doing something wrong. About 85 percent of the time, it is seen that the problem is over-watering! They may die quickly or over a number of years, but a stressed plant is an open invitation for insects and disease. They are also susceptible to environmental damage from early or late freezes, or heavy snows.

Water needs for trees and shrubs are generally going to be less than that of a green lawn area, although some trees will need winter water applications to prevent die-back of twigs and branches from our cold, dry winter winds. Late-fall installations are especially susceptible to winter-kill because they may not have adequate root development, as are birch, and poplar trees.

Trees and shrubs have different watering needs than lawns, and tree roots always grow far beyond the "drip line" of the parent plant. Remember too that 90 percent of a tree's feeder roots grow within the top 18" of soil. These can be easily damaged by compaction or trenching for paths and construction, addition or removal of soil where roots grow, deep tilling or cultivation, applications of weed controls or soil sterilants.

Naturalized landscapes, in general, require less maintenance overall and live longer than heavily pruned formal landscapes. This is because plants are allowed to grow to their natural size and shape. Are you pruning because your plant won't let you in the front door, or because it's eating your mailbox? This is a sign of poor design and plant placement. Tree and shrub pruning should only be performed to promote healthy growing conditions, minimal watering, to correct irregular growth and remove dead or dying branches and limbs. Improper pruning leads to plant stress, which invites insects and or disease, and all the rest.

Final Recommendations

The best recommendation that can be made for any landscape effort is, "Keep it simple." This includes design, irrigation, and maintenance. The more naturally your landscape can be allowed to grow the more maintenance free it will ultimately be. Why fight nature, (especially when she's unbeatable)? It is to your best advantage to work with her so that she will work for you.

Do You Really Need an Automatic Irrigation System?

Jim Clark

While dragging a hose around and moving the sprinkler on a summer evening—for what seems like the thousandth time—do your thoughts ever wander to the time-saving pleasures of an automatic irrigation system? There are several points to consider, including time-savings, in the decision-making of whether or not to install an automatic irrigation system for your landscape.

A residential automatic irrigation system typically consists of pop-up sprinklers that are supplied with water through plastic pipe buried underground.

A controller—also referred to as a timer or clock—is programmed to electrically open and close the control valves at desired times and for desired durations among the system's zones. To conserve water each zone should have uniform solar exposure and be comprised of plants with similar water requirements. A small yard may only require four or five zones, whereas a larger yard may require twelve or more.

An automatic irrigation system might also include drip irrigation. Drip irrigation is an appropriate method of irrigating individual trees, shrubs, or flowers, such as in a planting bed, when the plants are not densely spaced.

An automatic system compared to manual irrigation saves the time involved in moving hoses and sprinklers, and in turning the water on and off. For most homeowners with an automatic system this is seen as it's primary advantage.

Do Irrigation Systems Save Water?

A properly designed, installed and maintained automatic system will deliver a more uniform application of water to the landscape than is realistically possible with manual irrigation. This results in two potential benefits. First, there is the horticultural benefit of a uniform application of water that will not leave one portion of the irrigation zone under-watered and another portion over-watered. Second, an irrigation system with uniform delivery is more water-efficient, thereby saving money. Both of these benefits are qualified with the word *potential,* because neither will occur if the homeowner does not regularly and properly attend to setting the irrigation schedule on the controller. A great deal of water is wasted by homeowners with automatic systems that are set to irrigate according to the water requirements of a hot, dry week in July, whether it is May, September or raining.

Another advantage of an automatic system is that it can easily be programmed to irrigate during the early morning hours before sunrise, which would be inconvenient for those who are irrigating manually . This is the best time to irrigate, since the least amount of water is lost to evaporation from the sun's

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Jim Clark is the water conservation specialist for the City of Fort Collins, and has a background in horticulture, agricultural engineering and community education. As a personal voluntary endeavor, he is spearheading an effort to establish a Community Horticultural Center in Fort Collins.

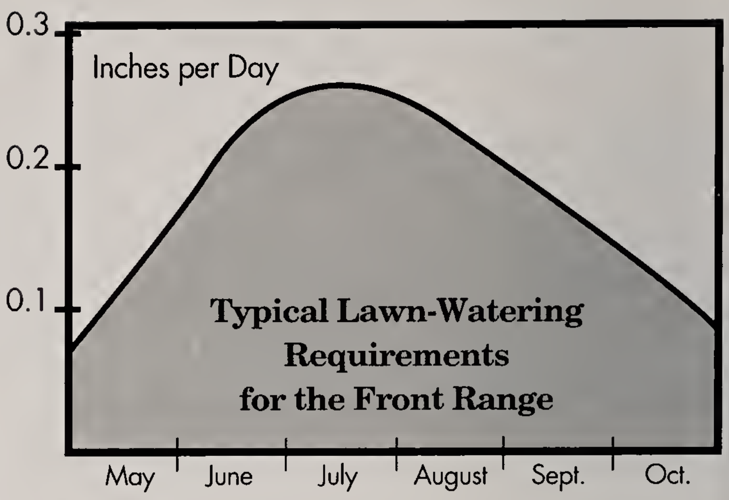
heat. Yet another benefit of an automatic system is the fact that it can be relied upon to irrigate your landscape while you are away from your home for extended periods.

The cost of an automatic irrigation system is its major drawback. The price for a typical system with eight zones on a 7,500 square foot lot is in the approximate range of $2,000 to $2,500. This is for a high quality, contractor-installed system.

If you install an irrigation system yourself (see *An Irrigation System on Your Own*, page 42), you could save 50 percent or more of the above cost. If you sell your home, you will likely recoup some of the cost of the system. Real estate appraisers currently value a typical-sized irrigation system at anywhere between $500 and $1,500.

After your automatic system is properly designed and installed, whether by you or by a contractor, there are several things that you can do to assure yourself of its efficient operation and water-savings ability. Good maintenance of an irrigation system involves being observant of its operation. The system should be routinely monitored for proper operation, checking for such things as: 1) broken, clogged, or maladjusted sprinklers; 2) pipe leaks; and 3) zones not coming on at the expected time or for the expected duration. If your system typically comes on while you are asleep or away, you should run it through a test cycle (with one or two minutes per zone) every few weeks so you can observe its operation. If you find any problem with the system, see that it is repaired by a qualified person. Also, the system should be properly winterized during the fall, to prevent the water in the system from freezing and causing damage.

The most essential determinant to an irrigation system's water efficiency is the scheduling. At the very least, your irrigation schedule should be adjusted monthly, based upon the water requirement of your lawn. Water needs gradually increase in the first half of the growing season and then decrease in the second half. Better yet, adjust your irrigation schedule on a weekly basis, using your landscape as a visual guide.



In all cases, you should turn off your system when you have received adequate moisture by rainfall. There are inexpensive rain sensors available that will perform this task automatically. Additional information on lawn watering is available from water utilities and from CSU Extension. If you do not understand how to program your controller, get assistance from an irrigation system contractor or other knowledgeable source.

Granted, all of this maintenance requires time (or money, if you pay someone to do it), which is what you were trying to save by getting the system in the first place. However, once you establish an efficient maintenance routine, it will take only a minimal amount of time; certainly less than that required for manual irrigation. Furthermore, you will be compensated with a better-looking landscape *and water savings*. The decision that you must make is whether or not these benefits are worth the financial cost of the system.

Left, sculpture adds interest to this naturalized planting of ryegrass.

Below, at the same residence, the buffalo grass meets the ryegrass border for a natural but well-manicured effect.

An Irrigation System on Your Own

John Stinson

Today we see all manner of landscape sprinkler systems, even at the most modest homesites. While many people still consider a sprinkler system to be a luxury item, most will agree that it represents both a time savings and a convenience, two increasingly valued commodities.

For many homeowners, the substantial investment of a sprinkler system is practical only if they undertake to install it themselves. As a general rule you may expect to save 40 to 50 percent of the cost of a professionally installed system when you do it on your own. Such a do-it-yourself project also offers the benefits of complete quality control and personalization. The major expense, of course, is personal time. Bear in mind that a complete automatic sprinkler system for an average urban residential lot will take 60 to 80 hours to install. Plan your schedule (and gather your friends, good neighbors and family) accordingly.

Assuming you have decided to stop dragging a garden hose around, and you are willing and able to undertake this project on your own, you will have to prepare a plan.

First, consider the areas to be watered. Small areas may be designed to be activated manually and may include above-ground piping and sprinkler heads. Drip systems can even be tied into an existing outside hose bib for water supply (like old-fashioned hose watering, except the hose, or pipe, is fixed in place.) Drip systems can also utilize drip or bubbler emitters placed along small-diameter plastic pipes that are routed near each plant. Each emitter delivers ½ to 2 gallons per hour. Because of this precisely delivered, low flow of water, drip irrigation has the advantages of: 1) being more water-conserving than sprinklers (less water lost to evaporation, wind, and runoff); 2) encouraging fewer weeds in the planting bed (water is only delivered to the desired plants), and 3) lower cost than an underground sprinkler irrigation. It is not a panacea, though. The primary drawback is that drip irrigation requires more concerted maintenance in keeping emitters unclogged, especially since the emitters are less visible.

More complete systems may include below-ground piping, permanent plumbing, advanced multi-use controllers (timers), and automatic rain and soil sensors. There is, of course, a whole range of options in between these types of systems. You will customize yours according to your specific desires. Be aware that any outside irrigation that is connected to your potable water supply must have a properly installed backflow prevention device to protect your drinking water from contamination.

Do not hesitate to consider modifying existing or planned landscape areas to better accommodate an irrigation system. All sprinkler heads and emitters have a specific optimum distribution radius (head spacing) that will maximize their performance and minimize water waste. In general, try to avoid

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John Stinson is a graduate of the CSU Landscape Horticulture Design program. He owns and operates Colorado Design Group. John is president of the Denver Chapter of the Associated Landscape Contractors of Colorado, is first vice-president of its state board and is on the board of Xeriscape! Colorado narrow strips, small angles and small island areas which are completely surrounded by plants with different watering needs.

Look particularly closely at any turf areas you wish to include. Existing lawns that are hard to water, have lots of run-off onto paved areas or continually show stress or wear will not be significantly improved by a sprinkler system. These areas are prime candidates for planting conversions or renovations. Consider how each area might be better utilized. Easy-to-water areas tend to be relatively flat, large (8' or wider) and simply shaped. Many times, small changes in lawn areas or planting beds will allow for great water economy, improved appearance and lower maintenance.

After you have decided on a workable layout for your plantings, you will need to record it in a scale drawing. Then you will need to develop a detailed irrigation plan that relates to it. This work can be accomplished, also, with the aid of a professional irrigation designer who can determine the best use of the myriad irrigation products available for your specific needs. By accurately zoning your system in relation to planted areas you or a professional designer can ensure the most efficient and cost-effective layout for your irrigation.

Most designs will include an itemized parts list for your shopping convenience. Some design outlets even offer helpful installation classes.

Information resources for design services include local hardware stores and building centers, plant nurseries, garden centers and your local landscape contractor association. In addition to your scale drawing your designer will request information on the size of the water line to your house and the static line pressure (city water service) or holding tank size, pressure and recovery rate (well water service). Have them explain this to you.

If you should decide to design your own system, be sure to have it checked over by a professional. The most common error in do-it-yourself systems is to give in to the urge to economize by “stretching” the system, that is, by spacing the sprinkler heads too far apart or adding too many heads to a zone. This is false economy and will result in a poor substitute for a professionally designed sprinkler system. Don’t hesitate to ask for help at your sprinkler parts supplier. If they are unwilling or unable to help, find another who’s willing to spend the necessary time.

Before you begin construction of your system, make sure you have carefully scheduled the work on paper. Allow for delivery or pick-up of all the parts and for any portion of the work that is being contracted to be completed well in advance of your own work dates. Make sure that any rental equipment is reserved and ready to go. Also, allow for rain delays and late arrival of parts or helpers.

The parts for an average complete automatic residential sprinkler system will fit into a compact pick-up truck and will take approximately 30 minutes to load and unload.

The work that you may want to consider contracting includes installation of a tap (copper pipe and brass fittings), the manifold (PVC pipe, gluing and valves), the controller (electrical wiring connected to valves) and the trenching.

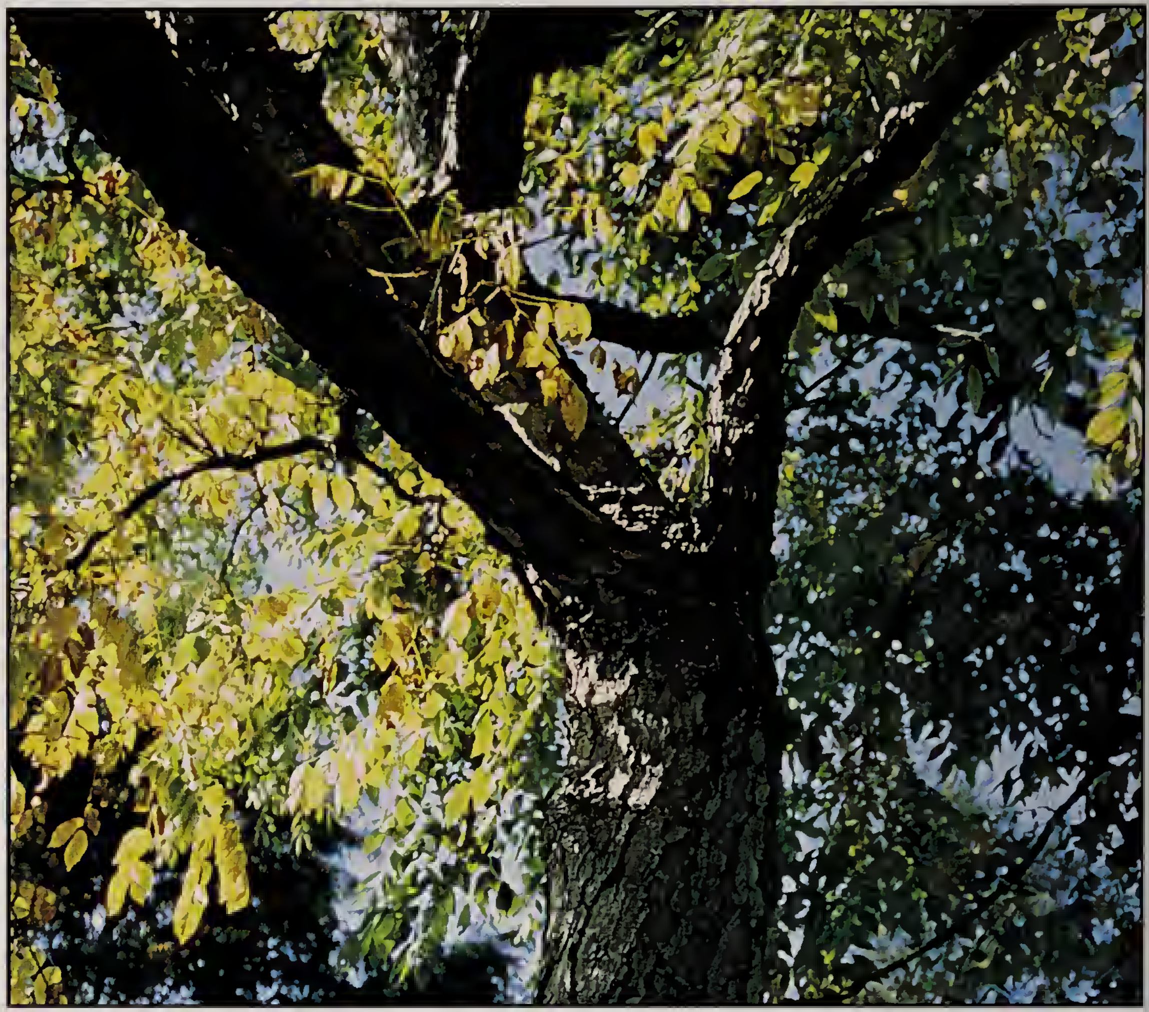
The previously mentioned sources of information will be able to refer you to reputable contractors for these jobs. Require proof of liability and workman’s compensation insurance before allowing any paid workers of these contractors on your property.

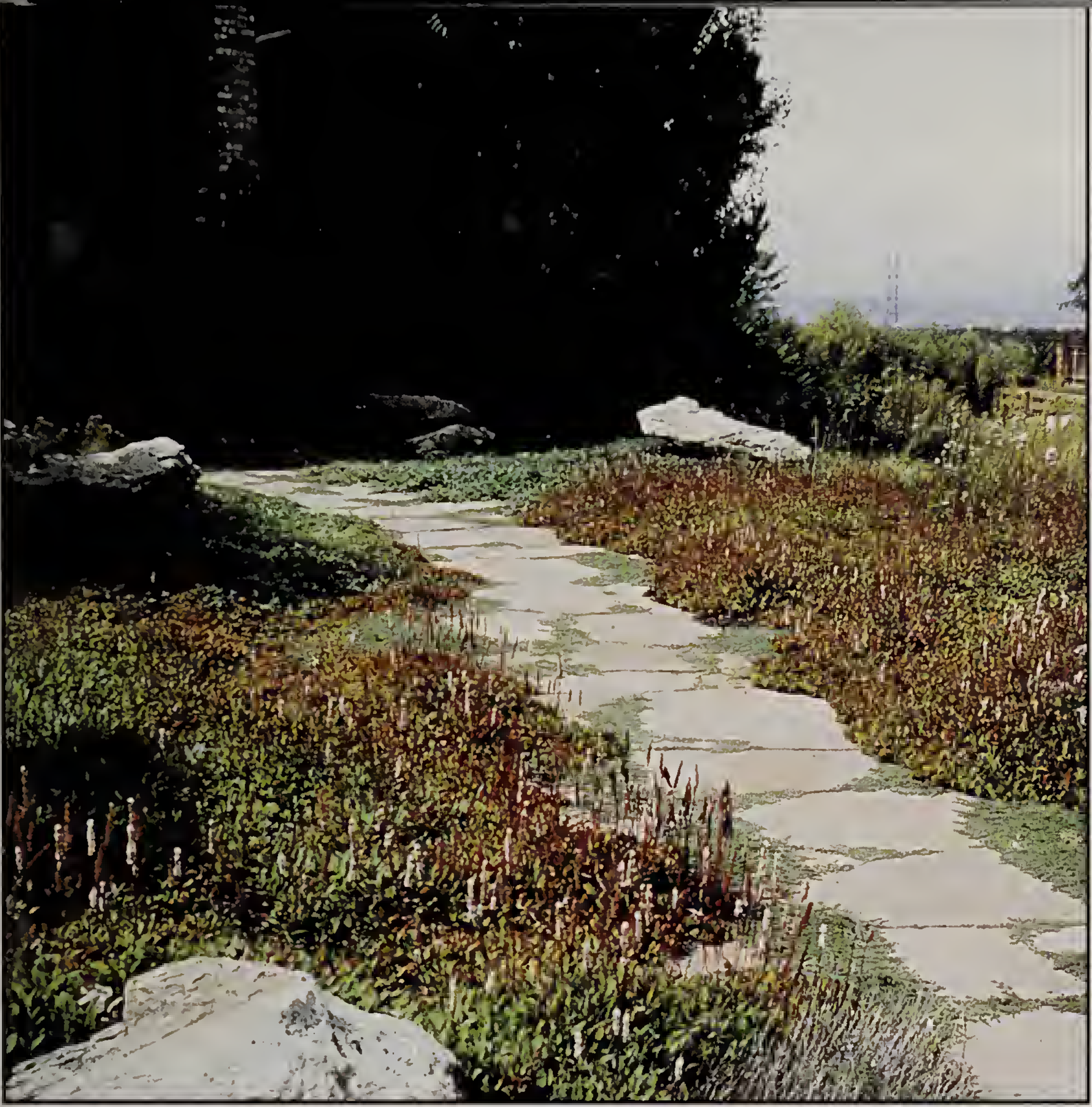
Rental equipment may include a trencher. A hydraulic, walk-behind model rents for about $150 a day. You may also rent cleaning shovels, a torch and boring tools for reaching areas that are accessible only by going under pavement.

With careful planning and use of readily available resources a do-it-yourself irrigation system can become a delightful reality. While not for the feeble or faint of heart, this seemingly daunting challenge can become a weekend project that is surprisingly simple. It will provide years of benefit to your landscape. Just be sure to take advantage of professional services available, remain calm and patient and be open to a great learning experience.

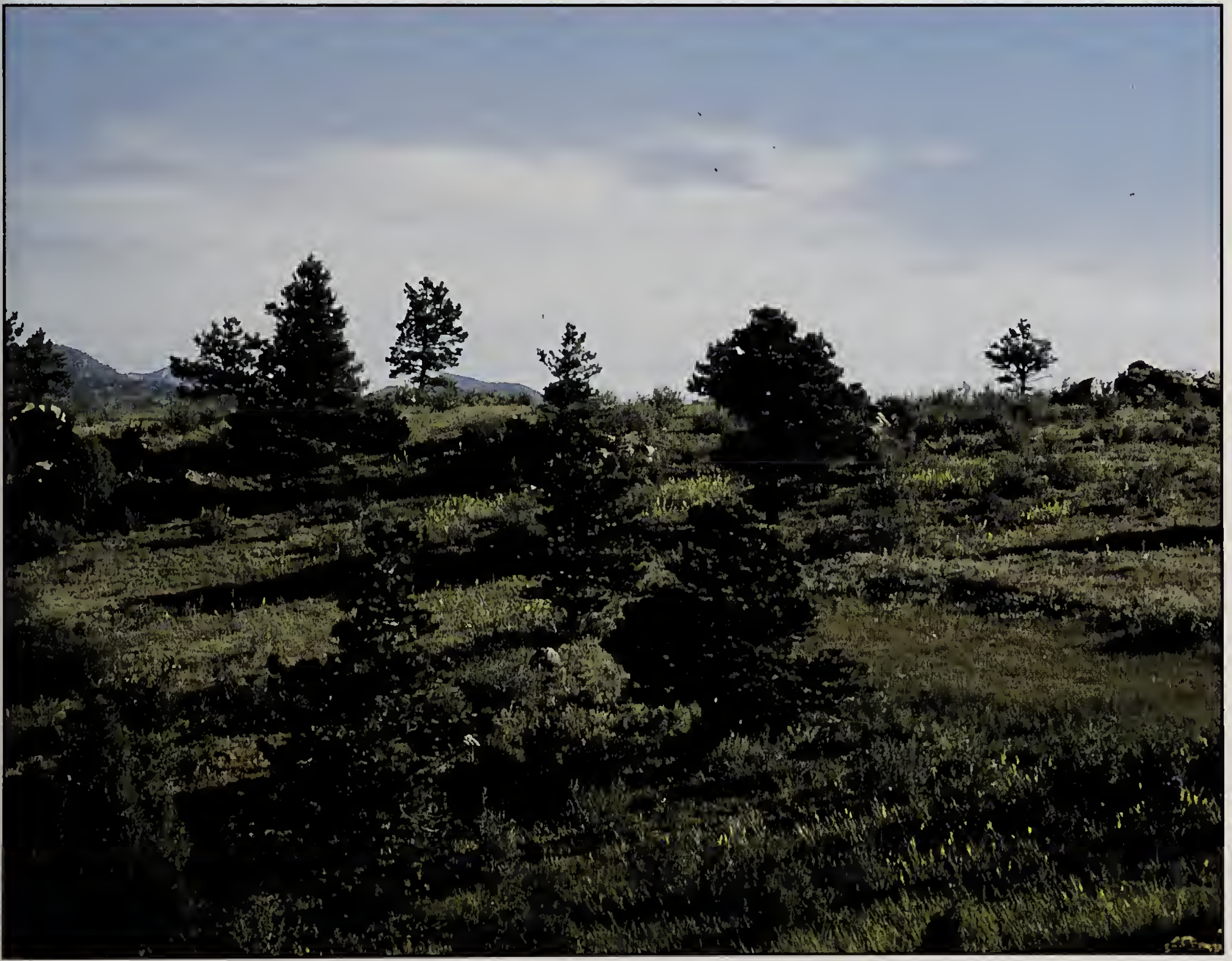
Right, Kentucky coffee tree (*Gymnocladus dioica*) showing its yellow fall foliage and light grey bark

Below, left and right, before and after photos show a septic field installation that has been reseeded with plant species collected from the surrounding site. (See story p 46.)





Left, an inviting walkway surrounded by border jewel (*Polygonum affine*) and wooly thyme (*Thymus pseudolanuginosus*)



A NO-Water Garden?

Connie Ellefson

Water-wise gardeners are frequently cautioned that they will need to water their newly installed landscape plants with some regularity until they are established. While this is usually true, dryland gardeners will be delighted to learn that, even in Colorado, it is possible to establish a no-water native plant garden right from the start.

Owners of a vacation cabin in the foothills west of Denver faced the unique opportunity of putting in a new landscape with no water supply available whatsoever. With the help of their landscape architect they were able to fashion a beautiful foothills landscape featuring native plants such as ponderosa pine, chokecherries, currants, gaillardias, penstemon, liatris, linaria and native grasses. However, a combination of know-how, excellent timing and patience was necessary.

Grass and flower seeds collected from the site or purchased to replicate the indigenous vegetation were sown in late fall and mulched with straw to control erosion and conserve moisture.

Other materials that have been used are jute netting, excelsior blankets and other biodegradable fabrics that decompose after the first or second season. (Fine plastic netting is not recommended because animals can get tangled in the material.) In the spring, seeds germinated when the weather was warm enough, taking advantage of the accumulated winter moisture retained by the mulch.

Shrubs, including some natives propagated in nurseries and some transplanted from a condemned section of the property, were planted as soon as the soil could be worked in early spring. In this way they had a high soil moisture content to draw upon, and the longest possible to establish themselves before the next winter.

The resulting landscape fits unobtrusively with its surroundings. Despite the difficult planting conditions only 25 percent of the plants died, an acceptable percentage for these conditions.

Gardeners interested in taking up the challenge of establishing a no-water landscape need to be aware of the risks involved. Patience is not only a virtue, it's a necessity! It may take two or three years for the landscape to become fully established. Weather may blow, wash away or dry up the plants before they are established. Some native grass seeds are also extremely slow to germinate. This is part of their survival mechanism; nature reserves some of the seeds to germinate later, in case the first wave of seedlings fails to survive a summer with little or no rain.

In working to develop a no-water garden it's essential to use species that grow on or near the site. For maximum establishment, native plant experts recommend the use of plant genotypes that grow within a hundred miles of the site's locale. In this way we also encourage the continuation of truly native species. It is otherwise unethical to remove plants from the wild unless the area has been condemned. And, of course, it is necessary to get permission from the landowner before removing plants, even on condemned land.

Connie Ellefson is co-author of *Xeriscape Gardening, Water Conservation for the American Landscape*. She is also a partner in Western Polyacrylamide.

Seeds may be gathered from existing native plants, but this takes considerable planning, good timing and a familiarity with the seed-setting cycle of each plant. The Colorado Native Plant Society recommends that unless one is an expert, it's better to purchase seed from reputable *local* dealers.

Soil preparation for native plants in no-water landscapes is simpler than tilling the soil and incorporating maximum amounts of organic matter, as is nearly always recommended in traditional gardening. Many native plants are adapted to very poor soil, and putting them in an enriched soil environment will most likely encourage leggy, spindly growth that is prone to insect infestation and disease. In the case of the two most prevalent native grasses used for seeding in Colorado, buffalo and blue grama, fertilizer is not recommended.

Tilling also brings out the bane of all gardeners, weeds! Turning over the soil exposes thousands of weed seeds to the warmth and sunlight they have been waiting for to germinate. To establish stands of either wildflowers or native grasses it is worthwhile to disturb the soil as little as possible. Instead it is recommended to merely scratch the surface, spread the seeds, scratch it again, mulch, and water (if possible) or wait for rain to enhance germination.

For trees and shrubs, water-thrifty gardeners will again forego traditional advice to work in as much organic matter as possible into limited planting holes. Considerable research now shows that this technique serves to limit the growth of the plants, because the roots tend to remain in the planting hole instead of growing into the surrounding soil. It is now advised to simply loosen the soil in a fairly wide circle around the plant, up to five times the diameter of the root ball.

The challenge of establishing a no-water garden is that it requires much more thought than establishing a traditional landscape. One must also be willing to abandon traditional methods of installing plants. But less can be more. For many of us, this is what makes water-wise gardening so much fun!

Right, Cheyenne privet with late summer berries

Below, Cheyenne privet hedge in full color

Soil—The Living Sponge

Gary Finstad

Unless you're a devoted gardener, mud wrestler or child under six, you probably don't consider soil a major factor in your life. But, of course … it is! Soil is the "living sponge" that supports much of the life on our planet.

Landscape design and management tends to focus on above-the-ground aesthetics: the sizes, shapes, colors, textures and arrangement of plant materials in the landscape. Yet, what happens underground—silently, out of sight—really determines how healthy, vigorous and water-efficient our plants and landscapes are.

Good soil literally "breathes" life into our plants and makes efficient water management for lawns and landscapes possible, saving not only water and money, but time and energy, as well. A small investment in the health of the soil should be regarded as an irresistibly lucrative business deal.

How do you ensure your soil is "healthy?" First, dig a hole into the soil and get to know it. You can dig anywhere on a new home site. If your home is already landscaped, select a spot in your lawn. Grab a spade and dig a hole at least 18" deep. Make observations as you dig.

If your first observation is that you've hit concrete, don't despair; you're learning! You've just discovered something about "soil depth."

Once you get deeper, look closely at the upper 6" to 8". Much of your applied water and plant nutrients are stored and used in this zone. The healthier the soil, the greater the depth of root growth and soil water storage.

On a new home site, there probably is no "topsoil." Topsoil is not always "whatever it is on top." Topsoil is, strictly speaking, the uppermost, organically enriched and biologically active layer of a natural soil. It's home to billions of living organisms, most of which are busy recycling organic matter like dead leaves and lawn clippings into nutrients, eventually making them available to your plants.

With only a few exceptions, Colorado soils lack organic matter and have, naturally, only 2" to 6" of topsoil. A new home site will nearly always need additional organic matter. Ignoring this fact is foolhardy, for the return on a dollar invested in soil improvement is greater than anywhere else in the landscape—and the penalty for omission can be severe. A property owner will forever be cursing himself, or his predecessors, for the time, money and trouble required to care for half-hardy plants in an unhealthy soil.

Organic matter, as it is converted into humus by soil microorganisms, improves "soil structure." Structure is the way individual soil particles group themselves. Good structure promotes efficient circulation of water and air within soil. This is important because an average soil is about 50 percent pore space—sometimes occupied by water and air, (see chart). Creating and maintaining good soil structure is the most important key to successful landscape maintenance.

Most clay soils lack good structure and, even though they have more total pore space than sandy soils, the pores are tiny and it's

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Gary Finstad is Lakewood Field Office district conservationist for the Soil Conservation Service of the United States Department of Agriculture.

difficult to get water to soak in. It's also difficult to dry clays out once they are wet. This isn't good because plants suffocate or drown in waterlogged soil.

Your soil examination will reveal information about another important characteristic: soil texture. "Texture" refers to the relative proportion of sand, silt and clay particles in a soil. Sand particles are easily seen. Silts are so tiny they feel like flour. Clays are even smaller—microscopic—and they lay flat against one another like matted leaves.

When we refer to soils as "sandy," "loamy" or "clayey," we're actually talking about texture. Different textures "feel" differently. They also possess different chemical and physical properties. Sands are easy to work, but are nearly sterile and drain quickly. Clays are difficult to work, but are very chemically reactive. Clays can lock up nutrients and water in mineral bonds, holding them against a plant's needs.

Soil texture can help you determine how often to irrigate and how much water to apply. Sands accept water readily, but don't store much. Clays accept water slowly, but hold it tightly.

To test for texture, simply moisten a small amount of soil and squeeze it in your hand. Sandy soil is noticeably gritty. It won't hold together very well. Clayey soil is very sticky and smooth. It will form a ribbon that won't break apart. Loamy soils are in between.

Loams possess some clay, but are dominated by roughly equal proportions of sand and silt particles. They are slightly sticky (clay), yet slick (silt.) You'll be able to feel some sand, too, and they hold together pretty well. Loams are the soils which tend to be best for most plant growth as they are generally fertile, accept and hold large amounts of water and air and are easily worked.

This doesn't mean, though, that you should add sand to a clay soil to achieve a better texture. Remember, clay and a little bit of sand are the ingredients for bricks, only slightly harder than what you might already have. The addition of organic matter at a rate of three cubic yards per 1,000 square feet is recommended in Colorado to improve any soil's texture and water/air holding capacity.

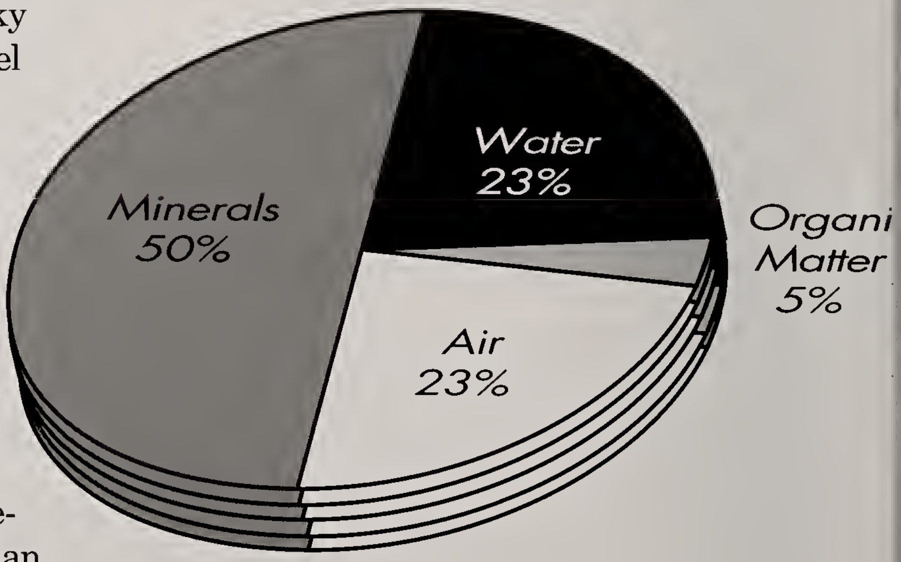
Soil under existing landscape plants cannot be easily improved. It may take a long time, but it can be done! Good landscape management practices—regular core aeration, appropriate fertilization, proper lawn mowing and watering, top dressing with organic matter—will, over time, encourage deeper and better root systems. As organic matter—living roots or decomposing tissues—increases, so will biological activity. Soil structure and the pore space network will gradually improve, making irrigation and yard care easier.

It's important to remember that the health and vigor of our plants is largely determined by what's happening underground. Dig a hole once in a while to see where the roots are growing and how deeply the water penetrates.

Also remember how important microorganisms and earthworms are in the recycling of organic matter and nutrients in soil. Indiscriminate or repeated use of pesticides and concentrated fertilizers may decrease or even eliminate this life. Use them sparingly and—always—according to the directions on the label.

Mud Pie

Composition of a healthy soil



Composting—Ultimate Recycling

Cal Kuska

People who know the value of compost in their gardens and on their crops have for years made it in a corner of their yard or beside the feedlot. Compost is most often valued for its ability to enhance root development. Research supports this thinking, showing growth up to 1,000 times more efficient than plants grown in depleted or chemically treated soils. Other benefits of compost include reduced need for irrigation, greater availability of essential nutrients, neutralization of toxins and enhanced soil warm-up in spring.

Other advantages include enhanced plant color, longer shelf-life of vegetables, reduced levels of nitrates in root crops, conservation of petroleum products used to produce fertilizers and reduced use of a non-renewable resource, peat moss. Using compost replaces the need for imported peat moss or local wetlands peat which is non-renewable because it is 4,000 to 10,000 years old. And, more recently, we have become aware that 80 percent of the U.S. landfills will be full by the year 2010. A home composting program can divert from 400 to 650 pounds of waste per household per year from going to a landfill.

Mother Nature has been our composter for centuries, but this natural process is too slow to be effective in our rapid-paced society. Raw compost, such as whole leaves, grass, food scraps and raw manures should be avoided as soil builders. Such materials rob nitrogen and other necessary nutrients from plants and soil while it is undergoing its slow decomposition process. Finished compost, on the other hand, is rich in humus, and readily available for use by plants.

Normally anything organic can be composted. If your neighborhood has rodent control measures, back yard compost units can accept food scraps (minus bones, meat, dairy and fatty foods) leaves, coffee and tea grindings, dead grass or green grass in thin layers, small pieces of paper without biodegradable printing inks, and wastes from the garden.

Home built composters and compost piles are more and more being replaced by factory-built, controlled atmosphere bins. These bins usually come with complete instructions, guarantees, aeration tools, rodent-proof sides and lids, and colors that absorb the sun's heat. These bins, with research and experience behind them, produce a product using either a "batch" or "continuous flow" process that takes only four to eight weeks, rather than a year or more.

There isn't another home-generated waste that has a better chance of being recycled than yard wastes. And by keeping kitchen waste from the sink disposal we save not only water but energy at the wastewater treatment plant. The balance stays out of the landfill, saving truck fuel, landfill space and potential groundwater pollution.

So take up the challenge: *Think globally, compost locally!*

Cal Kuska is the owner of Kuska/Associates, Denver, Colorado. He has been involved internationally in home and large-scale composting for 20 years.

Much About Mulch

Robert Cox

Mulch is a material placed on top of soil to inhibit weeds, reduce evaporation of soil moisture, moderate soil temperature, outline shrub beds and other planting areas, and provide color and texture.

Take notice on your next mountain hike of all the pine or spruce needles and aspen leaves layered on the forest floor. These natural mulches keep soil conditions under the mulch optimal for the plants growing there. The soil is moist and loose, air and water freely enter the soil, erosion is reduced and weed competition is minimized.

We can imitate natural forest conditions in the urban landscape by using mulches. Along with proper planting and watering practices, mulching is one of the most beneficial things we can do because it retards evaporation from the soil beneath, so watering is needed less frequently. It is an especially water-wise practice!

The ideal mulch permits air and water to penetrate into the underlying soil. It is nontoxic to plants, attractive, easy to apply, and free of weed seeds and disease organisms. It doesn't wash away easily in heavy rains or blow away in high winds and it doesn't ferment or burn easily. Mulches are either organic or inert (inorganic).

The most commonly available organic mulches in our region are grass clippings, leaves, pine needles, chunk bark, pole peelings, straw, hay, wood chips and shredded wood. Some areas have other materials such as apple pomace, spent brewery hops or crushed corncobs as by-products of local agricultural processing industries.

Note that aged manure, sawdust, peat moss and compost aren't listed. These materials are better used as soil amendments, mixed into existing soil to improve its texture, rather than as surface mulches.

Grass clippings can mat down and ferment if applied too thickly while fresh. They should be used in thin layers and allowed to dry before adding more. They are often better when mixed with another organic mulch. If mowing is sufficiently frequent, clippings are best left on the lawn, to decompose and release nutrients back to the lawn.

Leaves can similarly become matted into a slimy mass if used fresh in thick layers. If dried and shredded, they make a good mulch. If a shredder is not available, a power mower run over small piles of dry leaves will work.

Pine needles make an attractive mulch, but one which can be a fire hazard. Some people worry they will make the soil "too acid." Pine needles may be acidic, but Rocky Mountain soils are generally alkaline and resistant to drastic or quick change. Pine needles may be difficult to obtain in large quantities. One should not attempt to collect pine needles from public or private lands. Remember, they are mulch for the trees that dropped them. However, if you have friends who rake up pine needles and bag them for landfill disposal, why not intercept them?

Chunk bark of various sizes is sold by the bag at garden centers. It is usually ponderosa pine bark, a by-product of logging. A lumber

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Robert Cox is the Jefferson county extension agent, horticulture, for the Colorado State University Cooperative Extension.

Andrew Pierce

Left, close-up of bur oak leaves

Below, prairie zinnia (*Zinnia grandiflora*), *Verbena tenuisecta* and sagebrush (*Artemisia*)

Andrew Pierce

mill might have bark for sale, but it may be in larger chunks or strips.

Pole peelings appear like whittlings, and are the left-over result of trees harvested for exposed beams or construction logs. They interlock nicely and make good informal pathways, but they will compact and with time rot.

Straw or hay bales can be broken up and applied as a mulch. However, they may contain weed seeds. Wet or moldy bales may be less expensive and are still fine for mulch. Straw or hay mulch becomes flammable and easily windblown if it dries out. They can also be dusty to apply; a nuisance dust mask helps avoid inhalation of the fine particles.

Wood chips or grindings can be obtained from tree services or municipalities with a chipping operation. Pruned branches and “treecycled” Christmas trees are run through a chipper, shredding them into various sizes, mostly 1/2" to 3" in diameter. They make a very good mulch that doesn’t readily blow or compact. Appearance, though, varies.

Newspapers can be an effective mulch when laid down about ten sheets thick in overlapping fashion. To prevent blowing, cover the paper with three to four inches of one of the other mulches, such as wood chips. This is a very effective method for eliminating unwanted turfgrass or weeds. The newspaper smothers them and decomposes, leaving the overlying mulch in place. After two or three months, trees, shrubs or perennials can be planted in the area.

The bottom layer of organic mulches, in contact with the soil, slowly decomposes. Because most organic mulches are low in nitrogen, the decomposers may take up nitrogen from the soil. To prevent this, surface fertilize with a half pound of ammonium sulfate (21-0-0) per 100 square feet of mulched area. Top layers of organic mulch may weather to a greyish color; this and decomposition of lower layers may necessitate adding a thin topdressing of the mulch every two or three years.

Inert and inorganic mulches include stone and gravel, often used in conjunction with plastic sheets or various weed barrier fabrics. The use of plastic sheeting alone, or under other mulches is not recommended. Unperforated plastic does not allow water or air to enter the soil beneath it. Plant roots covered by plastic tend to develop in a thin layer just underneath the plastic on the soil surface, in an attempt to get sufficient oxygen. In the summer, these shallow roots are exposed to excess heat and to cold in the winter. Such shallow-rooted plants may blow over in high winds.

Think of the soil as a living, breathing organism. Don’t cover large areas of soil with sheet plastic. A good alternative to plastic is a weed barrier fabric or “geotextile.” While more expensive, these allow water and air into the soil and still reduce weed growth. However, most weed barrier fabrics must be covered with a mulch, as they degrade in sunlight. On steep slopes, mulches other than rock may not hold well on the fabric surface, especially during heavy rains.

Approximate quantity of various nitrogen fertilizers required to counteract the nitrogen-depleting effect of a bushel of average fresh, dry sawdust.

Nitrogen source	Nitrogen content (percent)	Quantity required per bushel (pounds)
Ammonium sulfate	21.0	1.2
Ammonium nitrate	33.5	.8
10-6-4 fertilizer	16.5	2.7
5-10-5 fertilizer	5.0	5.0

Mulch—More Pros & Cons

Curt Swift

Organic mulches have been reported to reduce problems with soil compaction and fluctuating soil moisture content. Also, they have been shown to reduce soil pH, (by increasing acidity, reducing alkalinity) a benefit most of our plants appreciate. A mulch of chips is even used as a "soft surface" to prevent personal injury in playgrounds.

The development of fine absorbing roots and the number of roots infected with beneficial symbiotic mycorrhizae increases in and under organic mulch, allowing plants increased access to nutrients and water. When organic mulch has been used to replace turfgrass, iron deficiency problems can also be reduced.

The benefits of organic mulch are many, yet disadvantages do exist, notably the increase in garden pests. Slugs, earwigs, pillbugs and sowbugs, cutworms and other plant feeders take refuge in the moist conditions found in and under organic mulch. While a mulch of sand usually does not provide a good habitat for these critters, gardeners who use rock mulches find these pests to be a problem.

Allowing turf to grow under trees or shrubs has proven detrimental to root growth of these woody plants, and can speed the decline of plants already suffering from iron chlorosis. Replacing this turf with an organic mulch increases root development and top growth and often reverses chlorosis problems. This also prevents what is called "lawn-mower-itis," mechanical damage to tree and shrub bases.

Yet the replacement of turf with mulch is sometimes more harmful to the tree or shrub than if the grass was left in place. Using a shovel, sod cutter or hoe to remove the turf can damage the shallow roots of woody plants and result in root rot or death. Eliminating the grass by suffocating it with sheets of black plastic or multiple layers of newspaper can also increase root diseases of trees and shrubs and is likewise not recommended.

It is better to spray the turf with an herbicide designed to kill grasses, being careful to avoid direct contact with trees or shrubs, then allow the grass to partially decompose before installing the mulch. Placing a thick, loose layer of mulch over the grass also will kill turf, apparently without the problem of suffocation. Oxygen is still be able to reach the soil and roots. If this layer is insufficient, though, the grass may be even more difficult to remove.

Most tree and shrub feeder roots grow within the top 18" of the soil surface. Growth of these roots is inhibited by compacted soil, low oxygen levels and extreme moisture and temperature fluctuations. Once a tree, shrub or other perennial is established in the ground, little can be done to amend the soil without damaging roots.

A layer of organic mulch can improve this rooting environment by increasing infiltration, reducing evaporation and increasing soil organic matter. Mulch can also act as an insulator, buffering the soil from rapid temperature changes and extremes.

This improvement of the soil environment has been shown to increase top growth of trees, as compared to trees grown in bare

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Curt Swift is an area extension agent specializing in Horticulture for the Colorado State University Cooperative Extension, Tri River Area.

Gaillardia in a wildflower plot at the Denver Botanic Gardens soil. Many new tree roots grow into the mulch, sometimes in higher density than in the soil itself. Silver maples and crabapples, especially, take advantage of mulch. Thus, these two species would benefit most readily from the mulch and would suffer the most severely if the mulch were removed for any reason.

Gardeners in areas where the snow cover disappears quickly find that their spring flowering bulbs emerge early and the flower buds get nipped by frost. A layer of loose organic mulch, applied *after* the ground freezes in the fall, keeps the soil cold thus slowing emergence. This same layer will help reduce soil moisture loss during the winter and early spring months. Dry soil in early spring can result in the premature budding of woody plants as well.

Reduced plant growth that generally follows an application of uncomposted sawdust has caused some gardeners to suspect that wood wastes contain toxic materials. Studies show, however, that except in rare cases, wood-waste (such as black walnut and oak) mulches are not toxic to plants when used in usual quantities and with supplemental nitrogen.

The oxygen that roots require must enter through the soil surface; any material covering the soil can interfere with that supply of oxygen. If applied too thickly, organic mulches can keep oxygen from reaching the underlying roots of trees and shrubs and cause suffocation. Researchers recommend that mulches be carefully selected to assure adequate air and water penetration anytime it is to be used more than four inches deep. Mulch should not be in contact with the bark of trees because decay and rodent damage can result.

Some homeowners opt to cover the entire landscape with gravel. Usually, the hoped-for savings on water bills and maintenance time is offset by higher cooling bills and other problems. Vast expanses of gravel also promote heat gain, which can be beneficial if appropriately placed. Such "rock-scapes," however, are generally monotonous and can reduce the value of your home. Some judicious use of rock can be very effective. Cobblestones, for example, can be used to create an attractive "dry streambed."

Turfgrasses near hot rock mulch areas dry out quickly and are more susceptible to attack by *Ascochyta* and dollar spot fungi. Mites are also a serious problem on turf next to rock mulch, and turf areas that warm up early in the spring are more prone to damage from white grubs, sod webworm and other turf insect pests.

Soil under rock mulch can be five degrees warmer than under wood chips, and seven degrees warmer than soil under a mulch of corncobs. This increase in soil temperature can be beneficial in areas where a quicker spring warm-up is desired, but in the warmer areas of the Rocky Mountains such an increase can restrict root development and reduce water and nutrient uptake.

Types of Mulches

Mulch Type	Advantages	Disadvantages
Cocoa-bean hulls	Long-lasting, dark color.	Tendency to compact, expensive.
Crushed corncobs	Uniform in color.	Retains too much moisture, compacts.
Grass clippings	Readily available.	Must be applied loosely, may mat.
Leaves	Readily available.	Not very attractive.
Peat (sphagnum)	Attractive.	May crust, expensive.
Pine needles	Attractive, often available, do not compact.	Fire hazard.
Sawdust	Attractive.	May crust if uncomposted, needs nitrogen supplement.
Shredded bark	Long-lasting and attractive.	Often expensive.
Straw	Readily available.	Blows easily, flammable, can contain weed seeds.
Wood chips	Long-lasting.	Not uniform in size or color.
Gravel & stone	Readily available.	Traps/reflects heat.

How the Fit Survive

Ray Daugherty

Plants have become adapted to living nearly everywhere on earth. The myriad forms we see, enjoy and use in our gardens are their unique methods of adapting to the challenges of their every environment. This adaptation, through evolution, is responsible for some of the most curious and beautiful attributes that endear plants to gardeners.

Evolutionary strategies for surviving periodic or prolonged drought are among the most interesting—and important—plant adaptations. Most such plants are placed in the broad ecological category of xeriphytes: literally, dry plants.

"Xeriphyte" and "xeriscape" are not synonymous. A xeriphyte is a plant that has, through evolution, modified its structure or life cycle to survive, endure or escape drought until moisture becomes available. Xeriscape, on the other hand, is the use of good, water-conscious gardening practices that reduce the amount of water used in a landscape. Xeriscape does not require the use of xeriphytes.

As a gardener, take up the challenge. After a fresh look at xeriphytes, their water-saving and ornamental value, you will begin to incorporate them into your landscape.

Perhaps the most common way plants conserve water is by the modification of their leaf surfaces. Some, such as lamb's-ears (*Stachys byzantina*) or silver sage (*Salvia argentea*) have evolved hairy leaves. This pubescence reduces water loss in two ways. It shades the leaf surface, reducing heat load on the leaf and a consequent need for cooling by transpiration. Also, the hairs act as baffles, reducing the drying effect of winds.

Such hairy-leaved plants usually appear grey, blue-green or silvery. In addition to their water-saving abilities, they break up the usual sea of garden green and accentuate flower colors such as pink, red and deep blue.

Other leaf surface adaptations also conserve water. Our native Smith's buckthorn (*Rhamnus smithii*) and needled evergreens have developed a waxy coating that acts like a breathable plastic, allowing the plant to take in air but inhibiting water loss. Needled evergreens also have fewer stomata (openings for the passage of gases, through which the leaf transpires, losing water) in relation to their size than plants which need more water.

In the garden these plants provide beautiful, dark backgrounds for silver plants, such as sages, and for straw-colored, late-summer grasses.

Still other plants, such as roundleaf buffaloberry (*Shepherdia rotundifolia*) have evolved a combination of these two coverings, scales.

Many plants have even modified the size and shape of their leaves. The closer in shape to a cylinder or sphere a leaf is, the less area it has in relation to its volume. And, all other things being equal, the smaller the surface area of a leaf is, the less water it loses. Many dryland shrubs, such as brooms, have nearly cylindrical or spherical leaves, as do sedums.

Leafy succulents, such as stonecrops and aloes (not hardy here), have taken the opposite tack, increasing leaf volume in relation to leaf area. Their greater volume of interior tissue allows for storage water.

Ray Daugherty is plant propagator at Green Acres Nursery in Golden, CO.

Some plants have the best of both worlds, wet and dry. They burst into leaf within hours after a good rainfall, then make and store food while the moisture is available in the soil. When their water supply dwindles, they quickly drop their leaves to avoid transpiration.

Several of our native mountain mahoganies have adapted another strategy, partial wilting. The leaves of *Cercocarpus ledifolius* and *C. intricatus* curl under during dry spells. This reduces water loss from the bottom surface of their leaves, where the stomata are arranged. The longer the drought persists, the farther the leaves roll under.

Stem succulents such as cacti and tropical euphorbias have evolved to delegate to their stems the usual functions of leaves. Leaves, where present, are ephemeral, dropping at the first hint of drought. This necessitates special morphologies and a completely different way of performing the major process of a leaf, photosynthesis.

Simply put, during normal photosynthesis, air (including carbon dioxide) enters the leaf through its stomata; carbohydrates are manufactured; and excess water molecules, oxygen and other gases exit. This usually takes place in sunshine, just when dryland plants can least afford to open their stomata. In the heat of the day they risk losing not only excess water but tissue moisture as well. But by a process called crassulacean acid metabolism, some plants are able to delay photosynthesis until nighttime, when it's cooler. During the day the sun's energy is stored in acid molecules, while the leaf's stomata are closed. The stomata open at night to permit the requisite transfer of gases and, through chemical change, the acid molecules release the stored energy, facilitating photosynthesis.

Nearly all gardeners are familiar with plants that store the bulk of their water supply away from sun and wind in swollen, more or less underground root, leaf or stem systems known as bulbs, corms, tubers or rhizomes. The stored water and carbohydrates support the plant in its natural period of "dormancy," which coincides with annual drought. Tulips, crocuses, cyclamens and our native sandlilies (*Leucocrinum montanum*) and sego lilies (*Calochortus* spp.) are examples.

Other plants store water and nutrients underground in a structure called a caudex, a combination of stem and roots. So large and efficient is this structure that the leafy stems, leaves and flowers that rise from the top of the caudex may be found flourishing even in years when all the surrounding vegetation is parched from lack of rain. It is not unusual for a caudex to attain the size of a person's leg and extend 10' to 15' underground. Native examples, excellent for dryland plantings, are bush morning glory (*Ipomea leptophylla*) desert four-o'clock (*Mirabilis multiflora)* and buffalo gourd (*Cucurbita foetidissima).*

The most common adaptation for surviving drought is also the least recognized: production of an overabundance of seed. Plants who take advantage of this phemonenon are called teliophytes.

Resources

Chris Call

Demonstration Xeriscape Gardens

Arvada: City of Arvada Public Works Center (303) 420-0984, 6161 Olde Wadsworth Boulevard, east side of building. One acre, featuring two turf types and 50 labelled plant species.

Boulder: Boulder Creek Xeriscape Garden (303) 441-3416, West of the Justice Center at 6th and Canyon streets. Quarter acre, featuring six turf types and 75 species of plants, including herbs. Interpretive signs with identified plants.

Boulder: Chataqua Park Ranger Station (303) 441-3416, 9th Street and Baseline, west of the paved road. 300 square feet of labelled native perennial flowers and shrubs.

Castle Rock: Douglas County Executive Building (303) 688-3096, 101 Third Street. 1,500 square feet, featuring one turf area and about 75 labelled plant species.

Chatfield Arboretum: Xeriscape Demonstration Garden (303) 973-3705, ½ mile west of Wadsworth Boulevard on Deer Creek Canyon Road. Two and one-half acres, with over 150 labelled plant species. Emphasis is on wildlife habitat, residential design and readily available plants.

Colorado Springs: Mesa Water Treatment Plant (719) 636-5407, 2855 Mesa Road. One and three-quarters acres, with over 150 species of plants, including 71 species of natives. Interpretive signs and plant labels.

Denver: Denver Botanic Gardens (303) 331-4000, 1005 York Street. Quarter-acre garden featuring two turf types and about 150 species of labelled plants.

Denver: Denver Water Department (303) 628-6343, 1660 West 12th Avenue. Quarter acre, featuring six turf types and 90 species of plants. Interpretive signs and plant labels. Different plant regions are zoned and equipped with water meters to show different water requirements.

Fort Collins: Fort Collins City Hall (303) 221-6681, 300 LaPorte Avenue. One-third acre, including three turf types and over 100 labelled plant species. Different plant regions are zoned and equipped with water meters for comparative purposes.

Longmont: Longmont Public Library (303) 651-8348, 3rd and Kimbark, south side. 400 square feet, with two turf types and about 50 labelled plant species.

Westminster: Semper Water Treatment Plant (303) 430-2400, 2 acres, featuring 6 turf types and 75 plant species with labels.

Other Resources

Organizations

American Society of Landscape Architects, Colorado Chapter	(303) 830-0094
Associated Landscape Contractors of Colorado	(303) 425-4862

Colorado State University Cooperative Extension Service:

Adams County	(303) 659-4150
Arapahoe County	(303) 730-1920
Boulder County	(303) 776-4865
Denver County	(303) 692-5600
Douglas County	(303) 688-3096

Cris Call is conservation specialist with Denver Water and the voice of Denver Water's conservation hotline.

Jefferson County	(303) 271-8980
Denver Botanic Gardens	(303) 331-4010
Denver Water Conservation Hotline	(303) 628-6343
The Irrigation Association	(303) 695-7711
Metro Water Conservation, Inc.	(303) 979-2359

Videos

Beautiful Gardens With Less Water.
32 minutes.
Produced by: Sunset Films and Television
Lane Publishing Company
Menlo Park, CA 94025

Sunset Waterwise Gardening, Western Edition.
32 minutes.
Produced by: Sunset Video
Lane Publishing Company
Menlo Park, CA 94025

Xeriscape—Appropriate Landscaping To Conserve Water.
Approximately 30 minutes.
Produced by: San Luis Video
P.O. Box 4604
San Luis Obispo, CA 93403

Xeriscape—A Quiet Revolution
28 minutes.
Produced jointly by: Denver Water Department and Denver Museum of Natural History
1600 W. 12th Avenue, Denver, CO 80205
2001 Colorado Boulevard, Denver, CO 80254

Xeriscape—Landscaping to Save Water, Time and Money
18 minutes.
Produced by:Virginia Jensen and Fred Liljegren
Department of Natural Resources
Division of Water Resources
1636 West North Temple, Suite 310
Salt Lake City, Utah 84116

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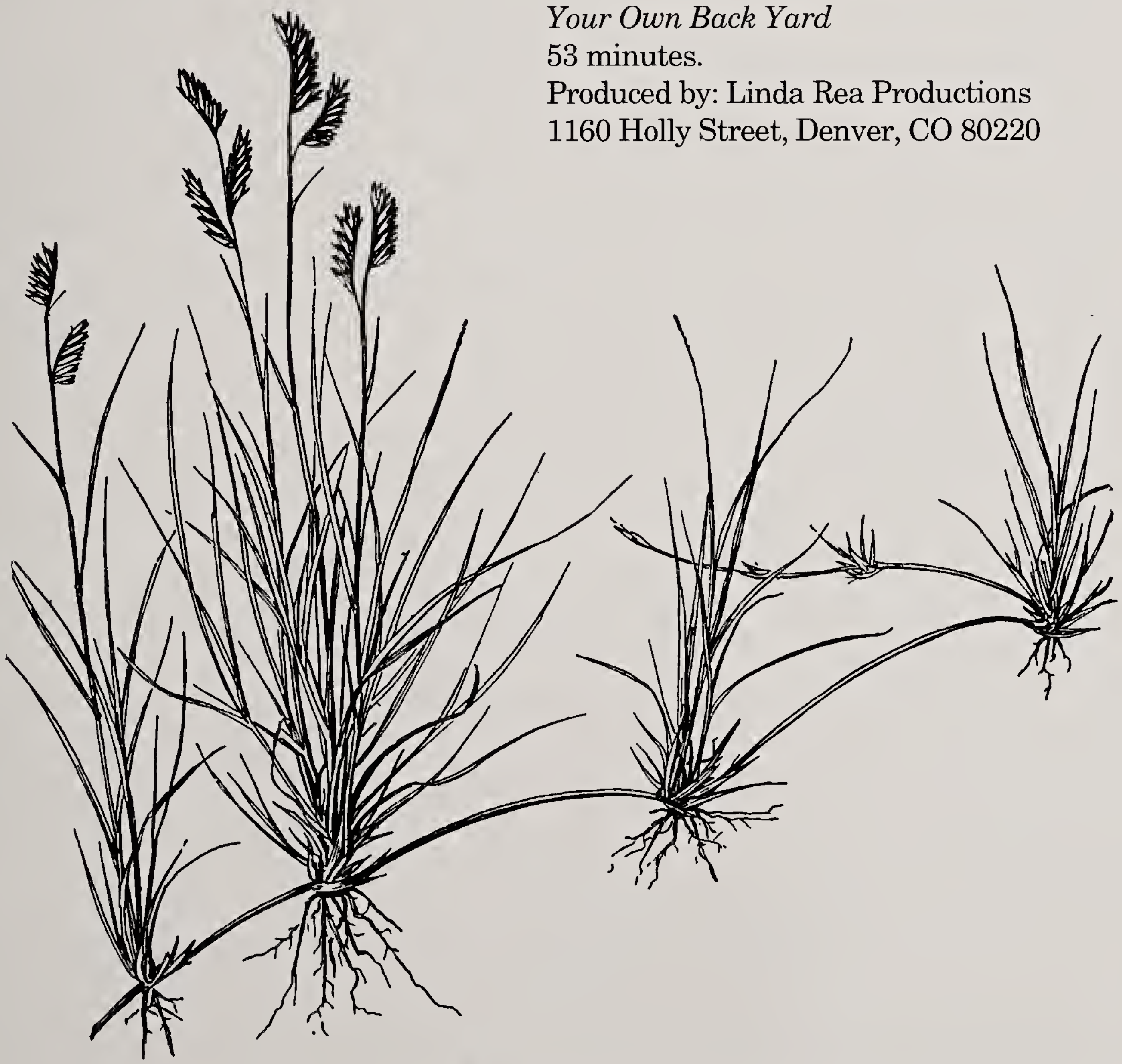

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Many pamphlets on xeriscaping and water conservation also are available at your local library or in the Helen Fowler Library of the Denver Botanic Gardens.

Solange Gignac is the horticultural librarian in the Helen Fowler Library.

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Mountain, Plain and Garden

Through our investigation of landscape we can express our sense of the connectedness of things, where we stand in relation to them. Above all, we come in touch with those over-arching abstractions that govern our perceptions: the great and the small, near and far, up and down, sharp and soft, smooth and rough.

—Wolf Kahn

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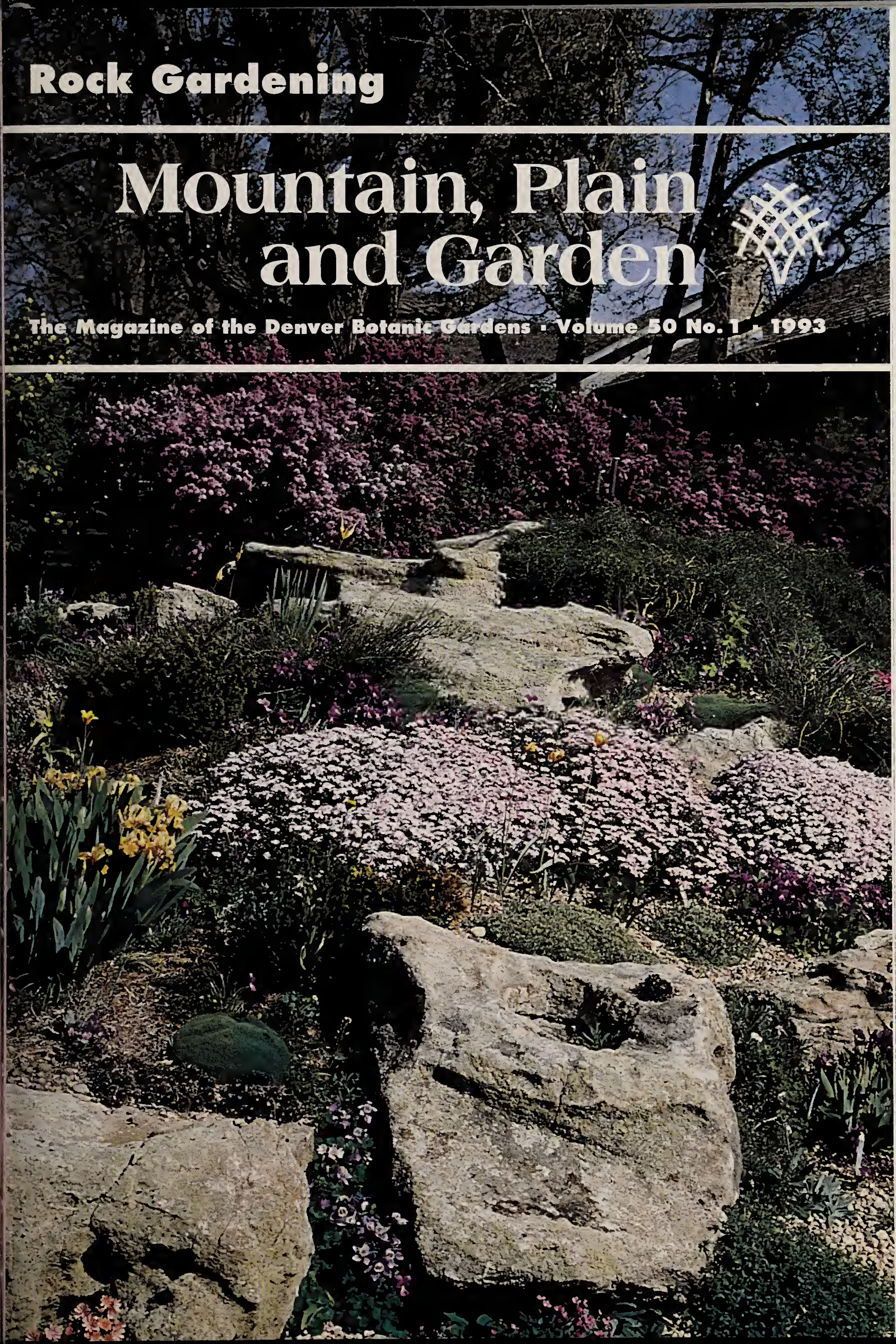
Rock Gardening

Mountain, Plain and Garden

The Magazine of the Denver Botanic Gardens · Volume 50 No. 1 · 1993



Dedication: To Pete Petersen

If you need to find "Pete," everyone knows who you are looking for. More formally known as Bernice Petersen from her bylines in innumerable *Green Thumb Magazine* articles, she has been a volunteer mainstay of the Denver Botanic Gardens since before its founding. She often introduces herself modestly as *"Populus tremuloides"* but—to the delight and enrichment of all who meet her—her friendliness and mental brilliance overshadow her timidity. Dispensing wisdom on native plants at the Plant & Used Book Sale or extending a welcome at Chatfield Arboretum's visitor center, Pete's generous smile encourages questions and exudes friendliness.

Clark Coe

Her love of alpine plants long pre-dates the completion of DBG's Rock Alpine Garden. In 1956 she and "Mr. Pete" built a two-story home on a steep triangular lot at the corner of Ridge Road and South Windemere in Littleton. Into every crevice and bed the Petersens tucked exquisite species of native plants, wildflowers and ground covers. Their yard abounds with unusual, horticulturally neglected, Colorado natives.

She was a natural choice three decades ago to chair the first native plant booth at DBG's annual sale. Pete's knowledge and enthusiasm have won an avid following of loyal customers. Her special interest has been shade-loving plants. Now, to take Pete out of the shade, the editors dedicate this issue of *Mountain, Plain and Garden* to her and salute our native star!

—Mary Washburne, Chatfield Arboretum volunteer and former DBG Trustee

Mountain, Plain and Garden
The Magazine of the Denver Botanic Gardens

Volume 50 No. 1 ❦ 1993 ❦ Rock Gardening

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Front Cover: Lilacs in the next garden echo the lavender color of *Phlox bifida* in Sandy Snyder's Littleton rock garden (see page 11) photo: Sandy Snyder
Back cover: An outstanding marriage of artistic rock garden design and choice plants is the garden of Ted Berginc in West Allis, Wisconsin, seen here blooming in May.

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Prelude: The Chamber Music of Gardening

Norman Singer

Whenever I am asked what the great attraction of alpine and rock garden plants is, compared to the pleasures of growing border perennials and other garden subjects, I fall back on my past as a producer of concerts and I make this analogy: Alpines are to perennials as chamber music is to symphonic music. The latter is big and noisy and brassy and highly emotional—good in its place. The other, the world of alpines and rock garden plants, is small and quiet and sophisticated and arouses the emotions by intellect.

For eight years in the '50s and '60s, I was the Executive Director of the Aspen Music Festival and Dean of its Music School where we were devoted to chamber music, albeit with a symphony orchestra on hand as well. It is the blight of my life that those eight years had passed before I became interested in, or was even conscious of, the individual plants of the tundra and subalpine areas where we would go for picnics among the "pretty flowers."

You can imagine what it feels like to return to Colorado, now thirty years later, as President of the American Rock Garden Society with its 29 chapters in Canada and the United States and with members devoted to chamber music plants in thirty countries around the world, and to have one of our flagship Chapters, the Rocky Mountain Chapter, hosting our fifty-ninth annual meeting this year in Vail.

If I was unlucky in my first encounters, or rather, non-encounters with alpine and rock garden plants, I have had no such misfortune with my association with Denver Botanic Gardens' Rock Alpine Garden. I first visited it in 1982, two years after planting had begun. The area was new and raw and the rocks were bold in their austerity. Every few years since, I have re-visited the garden, and it has been a repeated pleasure and an education to see the plants increase in size and number and variety, softening the background and asserting their presence against the now welcoming rocks.

It is not only local visitors who can be grateful to the garden. In it, plants from all over the world are tested. The promising subjects—through seeds, seedlings and cuttings—find their way into the nursery trade, then into the gardens of avid local and international gardeners. Thus the influence of the garden and its curatorial staff, their expertise and their generosity are experienced well beyond its borders. "Hardy in Denver" is a frequent imprimatur in plant and seed catalogs and it is immediately understood as referring to Denver Botanic Gardens' Rock Alpine Garden.

Many, many gardeners have been inspired to try all kinds of plants, even beyond the chamber music kind: perennials, ground covers, conifers too, which they might not otherwise have been brave enough or adventuresome enough to try if it had not been for Denver Botanic Gardens' Rock Alpine Garden. We are grateful to it. Long may it flourish!

Norman Singer is president of the American Rock Gardening Society. He gardens in counterpoint with Geoffrey Charlesworth in Sandisfield, Massachussetts. The resulting work is a classical concerto of choice alpine plants.

Robert E. Heapes

Right: In late May *Allium karataviense, Delosperma nubigenum, Dianthus deltoides* and purple and (rare) white forms of *Aster alpinus* enliven the outstanding garden of Robert Heapes in Parker, Colorado.

Below: Heapes' brilliant arrangement of *Phlox mesoleuca* 'Arroyo', *P.* 'Chameleon' and *Zauschneria garrettii* ushers in a Colorado autumn.

Thirty Something:

People & Plants of the Denver Botanic Gardens Annual Sale

Bernice E. Petersen

> *Give a man the secure possession of a bleak rock and he will turn it into a garden; give him a nine years' lease of a garden and he will convert it into a desert.*
>
> —*Arthur Young*

For almost 30 years members of the plant sale committee at Denver Botanic Gardens have been striving to deter that man with the nine-year lease; in addition, those who sell rock garden plants and ground covers at the sale have been guiding the man with the bleak rock.

"The Flowering of Denver," an appealing name for DBG's annual Plant & Used Book Sale, began as a plant auction on an October afternoon in 1949 in the Greek Theatre in Denver's Civic Center. It was a benefit for the Colorado Forestry and Horticulture Association, the organization that preceded and eventually merged with the Denver Botanic Gardens. About 60 individuals and firms donated trees, shrubs, perennials, supplies and services.

Charlotte (Mrs. Alexander) Barbour and John Swingle originated the idea. At some point in his career Swingle, a respected arborist, had picked up the hobby of auctioning, and, using the approved patter, he delighted the patrons, who laughed at him and with him as he sold the wares. Profits were $500; donations boosted the total to $850.

Over the years a variety of schemes and gimmicks were tried. Auctions were staged behind Horticulture House (CF&HA's Victorian headquarters at 1355 Bannock St.), at Cherry Creek Shopping Center, as part of garden fairs and shows, and finally at Botanic Gardens House at 909 York St. Profits fluctuated, but great fun and good fellowship always prevailed.

Native trees, shrubs and ground covers were offered for sale for the first time in 1962 at Cherry Creek, but volunteers groaned as choice unsold plants were auctioned at a fraction of their value.

In 1964 the sale turned "big time." Plants were chosen for their performance in test plots at DBG and in Denver's parks. Growers agreed to grow plants from seed especially for the sale, then held in the parking lot behind Botanic Gardens House.

Temporary shade was erected—the previous year plants and people had wilted in the intense sunlight. Volunteers were recruited from every possible source—garden clubs, study clubs, Boy Scouts. A panel of experts helped train the volunteers. A plant sale issue of *The Green Thumb Magazine* trumpeted the virtues of "the best by test" of annuals, perennials, gladioli and dahlias, and described the merits of using natives in our semiarid landscapes. Advance orders were accepted, but once of that proved enough.

Bernice "Pete" Petersen and her husband "Big Pete" have been champions of rock garden and native plants for Colorado gardens for decades, and invaluable supporters of Denver Botanic Gardens. Their Littleton home is a testament to their horticultural passion. "Little Pete" was once co-editor of DBG's *Green Thumb Magazine*, precursor to *Mountain, Plain and Garden.*

Customers came from near and far. The Gardens were at their blooming best, with 7,000 bulbs in full flower. The event was a sellout. The auction had been eliminated!

A native plant division that year included such rock garden standbys as *Mahonia repens,* kinnikinnick, pussy-toes, sulphur flower, *Yucca glauca, Y. baccata* and *Y. harrimaniae,* all from Western Evergreens, a Golden nursery, and all on consignment.

Our big break came the following year when Evelyn Johnson, a gardener in the English tradition and owner of Wheatridge Nursery, referred us to Alf Jensen. Alf was a grower whose specialty was cacti but who could grow any plant for which seeds or cuttings were available. He must have had an acre of *Phlox subulata* in various colors, and he delivered his boxes by the truckload, trip after trip.

Best of all, when asked for *Campanula garganica* and *C. muralis,* he understood and later grew *C. poscharkyana, C. collina, C. cochleariifolia* and *C. turbinata* as well. Alf provided such gems as androsaces, saxifrages, *Carlina acaulis* and an assortment of thymes.

By 1966 we boasted 50 kinds of rock garden plants suitable for a variety of conditions, from sun-parched slope to a protected shady nook. The following year, to our horror, the shade and the enthusiasm of everyone collapsed with the arrival of a typical spring snowstorm. Still, the sale grossed $13,000.

During these early years, a few nurserymen had protested the DBG plant sale. They thought it competed unfairly with their sales. Among them was Mr. Paul Hoy of Iliff Gardens Nursery. He later became one of our closest allies, and rock gardeners are forever indebted to him: he sold us our start of the charming native *Aquilegia saximontana,* the Rocky Mountain dwarf columbine.

Meanwhile, Colorado carnation growers, whose flowers were then deemed the best in the world, were experiencing disastrous competition from Colombia, S.A., where growing conditions were equally advantageous, without the necessity for costly heating and air conditioning.

Eager to diversify, Homer Hill was one grower who had an intense interest in propagating wildflowers and unreliably hardy exotics. We found him through Harry Swift and Larry Watson of Western Evergreens. He was responsible for propagating the Rocky Mountain dwarf columbine—until rock gardeners now probably have more of them growing in their gardens than can be found in our mountains. Among the many other treasures he propagated were shooting stars, rock ferns, Easter daisy, monkey flower, *Penstemon pinifolius* and *Potentilla thurberi.*

SaBell's Hillside Gardens, just breaking into commercial landscaping, proved to be another helpful supporter in offering many plants for rock gardens and the perennials division of the sale. Growing in their home planting was pink plumes, *Geum triflorum,* a jewel I first noticed in a meadow near our favorite fishing hole in South Park. Sabell's *Euphorbia polychroma* was always in flower at sale time. (Any plant that flaunted a blossom at sale time was a quick sale; retaining a plant as an example was the trick.)

Colorado blue columbine, *Aquilegia caerulea,* it seems, was one of the most difficult plants for growers to produce. Finally, Mr. Buck at Buck's Gardens agreed to try, if we guaranteed him fresh seed.

We knew Emma (Mrs. Edward) Mixa of Boulder had a lovely mass of columbines growing outside her picture window. A dedicated member of the Denver Botanic Gardens, she was happy to respond to our request. Paradoxically, she and Kathryn Kalmbach, for whom DBG's herbarium is named, made annual pilgrimages to the mountains where they carefully planted Emma's seed by patting it into the soil. They theorized that when columbine seed fell to the ground, it often failed to germinate without this extra pat. In her 80s, Emma telephoned me one summer, frantic, "Petie, we're in trouble! I found a yellow columbine in my garden—if anyone complains, I'll refund their money."

By 1973 our inventory included 100 kinds of rock garden plants. *Contemporary,* a Sunday section of *The Denver Post,* rejected a

The annual Plant & Used Book Sale has become a premier event for Colorado gardeners.

story on our plant sale. However the editor of *Roundup, The Post's* preweekend section, offered us its cover in living color: Katharine Bruderlin Crisp, one of the Gardens' oldest volunteers, had been the current plant sale chairman's teacher. Mrs. Crisp was pictured with Gloria Falkenberg's daughter as they surveyed DBG's little red wagon filled with columbines, pussy toes and other jewels. The caption: "Botanic Plant Sale: Where Natives Meet." Rock gardening had arrived in Colorado!

Usually, when new groups of plants were introduced to the sale, the rock garden section was chosen to introduce them. Trees and shrubs were shed early on. We sold wild strawberries and runnerless strawberries; then domestic strawberries landed on our tables. The next year the berry basket section was born. To increase revenues we opted for miniature roses. The rose division followed. Within the past two years, drought-tolerant plants for dry landscapes was the latest splinter booth. It now offers 200 kinds of plants.

Often at plant sales we found patrons more knowledgeable than we, so we asked them to join our fun, selling plants and dispensing cultural information. One was Panayoti Kelaidis—very knowledgeable and enthusiastic. Then, when the Rock Alpine Garden at Denver Botanic Gardens was under construction, Panayoti, a dedicated rock gardener since childhood, was chosen to be its curator. Suddenly, with his work and the experience of Andrew Pierce and Jim Borland, other staffers of DBG, the number of new introductions, both to the garden and to the sale, exploded.

The spectacular success of the Rock Alpine Garden has inspired many commercial growers. In 1992, 18 growers supplied more than 500 kinds of rock garden plants, including 15 varieties of columbine, 15 asters, 36 dianthus, 25 saxifrages, 18 veronicas, 14 penstemons—to name only a few.

Is it any wonder "The Flowering of Denver" is the biggest and most successful sale of its kind in the world? For some, customers and volunteers alike, the sale has forfeited much of its charm and personal contact, but for serious gardeners, novice or seasoned—especially rock gardeners—it's still an extraordinary opportunity to explore and expand our world of cultivated plants—in a festive atmosphere.

Rockwork

Steve Cohen

The recent surge of interest in boulder and rock alpine gardening in Colorado has been overwhelming. This gardening art form has fascinated and reached new heights of creative outlets for individuals varying in age, economic and professional backgrounds. Seemingly, the only hurdle that enthusiasts have to overcome is their physical and mental capabilities to move boulders and rocks into their gardens—the bigger the better.

So what attracts gardeners to aggressively seek out this high form of creativity?

Each of us has a unique relationship and understanding of nature. For the rock alpine enthusiast the integration of rock formations and plant varieties are ingrained by involuntary study and thoughts brought on by such experiences as nature walks and camping, fishing and raft trips through steep mountain gorges, canyons and valleys. Something strikes and sticks in our memory when gazing upon a formation of rock adorned by bluish-gray, rust-speckled lichen housing random but systematic patterns of sulfur flowers, antennaria and kinnikinnick. This thought or mental photograph is logged into our memory banks to be retrieved at home while sitting in the backyard. The photo is contemplated and then implemented.

But hold on—not so fast! What about the utility box and power pole? In order to look natural the swing set, sandbox and redwood hot tub need somehow to be incorporated.

Planning

This is about the time when you should consider sitting down with pencil and paper to sketch your rock garden fantasy. If you feel you need more information, consider a professional landscape designer/architect to address these issues and to identify drainage, site obstacles, accessibility to yard, plant varieties, irrigation methods and soil types.

Be sure to integrate sound soil management techniques in your rock garden. Backfilling rocks with poor soils will only lead to long-term frustration when it comes time to plant. Use soil media that are compatible to the plants' needs, be it a purely xerophytic type plant setting, to zoning out more water loving plants away from the latter. The investment you spend on plant materials will pay off if the properly enriched soil is used.

Selecting the Rocks

Depending on the scale of your garden, choose rocks native to the area. For example, when considering a large project when major terracing and retaining banks are in order with two- to five-ton boulders, inquire with local quarries or excavators. Due to an increase in demand in my mountain community, some excavators have inventoried boulders and are glad to oblige in delivering these boulders at a reduced price. City dwellers can choose from nearby stone suppliers on the outskirts of Denver or take the time to drive between Boulder and Lyons where several stone yards are located.

More budget-conscious hobbyists have been observed picking through the large rock piles left at the new mountain highway con-

---

Steve Cohen, with his wife Robin, owns and operates Evergreen Nursery in Kittredge, Colorado. He is also a designer and builder of naturalistic rock gardens.

Panayoti Kelaidis

Left: The "lower meadow" of Denver Botanic Gardens' Rock Alpine Garden in its mid-June bounty

Below: The "limestone cliffs" in late May with lavender *Veronica spicata* in the foreground, *Salvia* x *superba* 'May Night' in the background and yellow *Genista tinctoria* var. *flore-pleno*

Bottom: A close-up of the "limestone cliffs," with *Helianthemum canum* var. *scardicum* and *Veronica cinerea*

Panayoti Kelaidis

Panayoti Kelaidis

struction projects. Just be careful to ask for permission. Keep in mind that whatever the size of the project, rock and boulders properly installed are there to enhance and complement your future plantings.

The Art of Setting Rocks

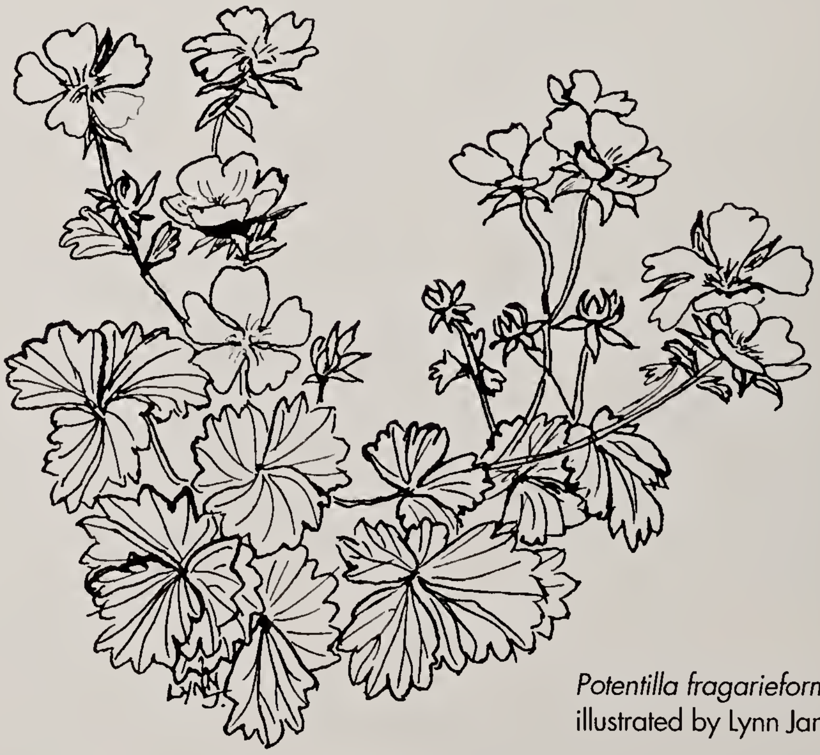
The most difficult part of installing rocks and boulders is to explain or even show how it is done. This is where creativity and the power of visualization skills are tested. However, there are some dos and don'ts.

Don't set rock on top of the ground. Dig them into the ground to make them appear as if they have been there for quite some time. Feature the more interesting side or corner of the rock. On occasions I have been known to bury a five to eight ton boulder one-half to three-quarters of the way into the ground or hill to achieve or justify a certain angle or look.

Clustering rocks into formations, using eight to fifteen rocks, can achieve a very effective "natural" rock outcropping. While setting some of the rocks into the ground, others can be used to overlap or sit on top of the ones buried. This technique can be used to form small to large planting pockets for low-growing blooming perennials.

Try not to overuse long, narrow rocks placed vertically. Rocks like these in large quantities tend to appear to be tombstones. Occasional use, though, can be attractive.

The trick to learning about this art form is to observe what Mother Nature or others have already accomplished. Take photographs of projects or rock outcroppings that are intriguing. When installing rock, sense with your mind's eye what looks natural. If you have to use a lot of props to make it appear natural (i.e. old stumps or wagon wheels) you probably missed the mark. The rock placement should look natural by itself before any props or plantings are considered. I have learned getting to this stage takes some practice, so start with smaller projects. But, unlike putting together a jigsaw puzzle, whatever the outcome, it is the personal interpretation of the artist within all of us that comes out in the field.



Potentilla fragarieformis
illustrated by Lynn Janicki

Building a Screen Garden

Sandy Snyder

Of the several kinds of gardens around my house, the rock garden in my front yard is the one I enjoy most. It is located near the front door, and it is impossible not to see what is happening in it every day. I can pull a weed or straighten some stones early in the morning on my way out the door. And there is no extra effort required just to stand and enjoy the flowers and plants one last time before the day is finished. The garden's location makes it easy to keep in touch. It is part of my every day.

My nearly circular garden is six feet high and thirty feet in diameter. It was built because I wanted to block the road from view—and to gently circumvent the community's zoning laws. These allow only a short see-through fence in front yards. Such a fence would not have blocked the view of the road from my front windows. A privacy fence that gave no privacy? It would not have been worth the effort or cost. But when I found out there was no restriction on building a high pile of dirt and planting anything on it, even sixty foot trees, I was ecstatic. I perceived a way to beat the system.

Reality set in. I did not want huge trees and shrubs surrounding the front of my house, to make the north-facing sidewalk and driveway colder and even icier in winter. I did want whatever I constructed to look presentable and fit into the neighborhood. I thought maybe I can even improve it by making it a more interesting and attractive landscape.

Sandy Snyder, horticulturist in the DBG rock alpine garden, lives in Littleton where she maintains an extensive, xeriscaped home garden.

First, the mountain

After building a French drain so the soil would not wash onto the driveway or the sidewalk, and removing all the plants except a few from around the edges, such as *Arctostaphylos uva-ursi* and *Genista sagittalis,* that would look good in a rock garden, I started out by dumping a big pile of dirt.

But it wasn't just dirt. It was a special soil mix. I had the gravel company mix six cubic yards of top soil, six yards of peat and eight yards of a stone mixture that consisted of two yards of squeegee (a grade between sand and pea gravel), two yards of pea gravel and four yards of crushed river rock ranging from fine to three-quarter-inch. This was mixed into the soil for drainage. This stone mixture was later used also as the mulch because it looked more natural than uniform sized stones. This was the recipe for the soil mix on the south side of my mountain—sunny, hot beds with excellent drainage—a bit of Wyoming and a perfect home for the little mat and cushion plants I like.

My vision for the north side of the garden was to develop a cool peaty woodland, the kind of landscape you might find in Scotland. I have very few north-facing gardens in my yard; this garden would be perfect for ericas and dwarf conifers.

For this side the gravel company mixed five yards of sharp sand, five yards of rich top soil and five yards of rotted sawdust. This would be the foundation for planting dwarf conifers and ericas. Small bulbs and other plants would be added to provide color, and interest. Thirty-five yards of custom-mixed soil cost $850.

Sandy Snyder

Hot yellow *Genista lydia* spills from the top of Snyder's unusual screen garden in June.

I did not put a heavy plastic barrier between the two different mixes because it had been my experience that such soil barriers are not necessary.

For the watering system I buried a hose to the top of the mound. It ends in a spike holding two sprinkler heads. One head is a full circle of coarse jets that waters the whole garden; the other head is a half-circle that sprays extra mist just on the north side. The north side, therefore, gets more water than the south.

Having plants with two very different water requirements back to back does present some problems. *Iris gatesii,* a magnificent desert iris from Iraq, rotted because it got too much water, even though it was located on the hot dry side with excellent drainage. But after much experimenting with nozzles and schedules I think that both the wet north side and the dry south side now are coexisting in harmony. I learned that some ericas are surprisingly drought- and cold-tolerant based on my experience in this garden. However, I do water the ericas every day during very hot dry spells to keep them from drying too much.

My six-foot-high mound was dubbed Mount Snyder by my gardening friends. I didn't particularly like this—I had dreams for my rock garden. It was supposed to provide an interesting sculpture/painting for my front entrance. However, the name was appropriate because the pile of settling soil did look like a hill in front of the Snyder house.

I let the soil settle for a couple of months before ordering and placing ten tons of large, light-colored, lichen covered sandstone rocks. It was a mistake not to allow for more settling. The soil should have been piled even higher. Now the mound is almost three feet lower than its original height. And, once the rocks were set, it was impossible to add more soil to increase the height of the hill. I hope over the years the plants will grow enough to compensate for this.

Five years have passed since I began this garden. It is no longer referred to as Mount Snyder. People who walk and drive by have forgotten that it was once just a big pile of dirt. Instead of fretting, neighbors, joggers, motorists and bicyclers seem pleased with what they see. Often they stop to ask about the garden and its plants. The garden is slowly developing the interesting colors and textures I had hoped it would have.

The Plants for "Scotland"

My first batch of plants came from Heath and Heathers Nursery in Elma, Washington—one hundred small pots of ericas. My husband and I drove them to Colorado in a cartop carrier. Plants grown in Colorado must be able to tolerate some winter drought stress during years when there is no snow cover. They may also have to tolerate summer drought when the sprinkler system malfunctions, or when I go away and do not plan on hot weather.

My ericas are a wonderful ground cover for a fairly steep area. They help knit the north face of the rock garden together. And when *Fritillaria meleagris,* the checkered-lily grows up through the ericas in the spring to show off its purple and white checkerboard petals, the erica makes a wonderful background. The ones I planted also make a perfect underplanting for dwarf conifers and they do a great job of keeping something in bloom in the garden all year.

In five years, I have not fertilized, trimmed, or re-propagated my heaths. Most of them are still alive and growing well in the conditions provided for them. The USDA zone evaluations don't seem to mean much for heaths planted in Colorado even though we don't have reliable snow cover in Denver and the winter temperature has reached lower than minus 20°F. Some years they suffered a little winter damage but they recovered quickly. However, I must confess we make use of all the snow we get by directing the snow onto this garden when we clear the driveway with the snow blower.

In general, our part of Colorado has a dry climate. It is difficult to over-water. The ericas have never had any sort of fungal or other disease problems. I love the way these carefree, reliable, good-looking ground covers bring color and interest to the winter garden as handily as they provide a dependable flowering mat in summer.

The other major group of plants on the Scottish side of my rock garden is the dwarf conifers. I tried to choose these evergreen miniatures so that their shapes, (tight cushions, conical or splaying) their various shades of green and their various textures complement each other and the plants surrounding them.

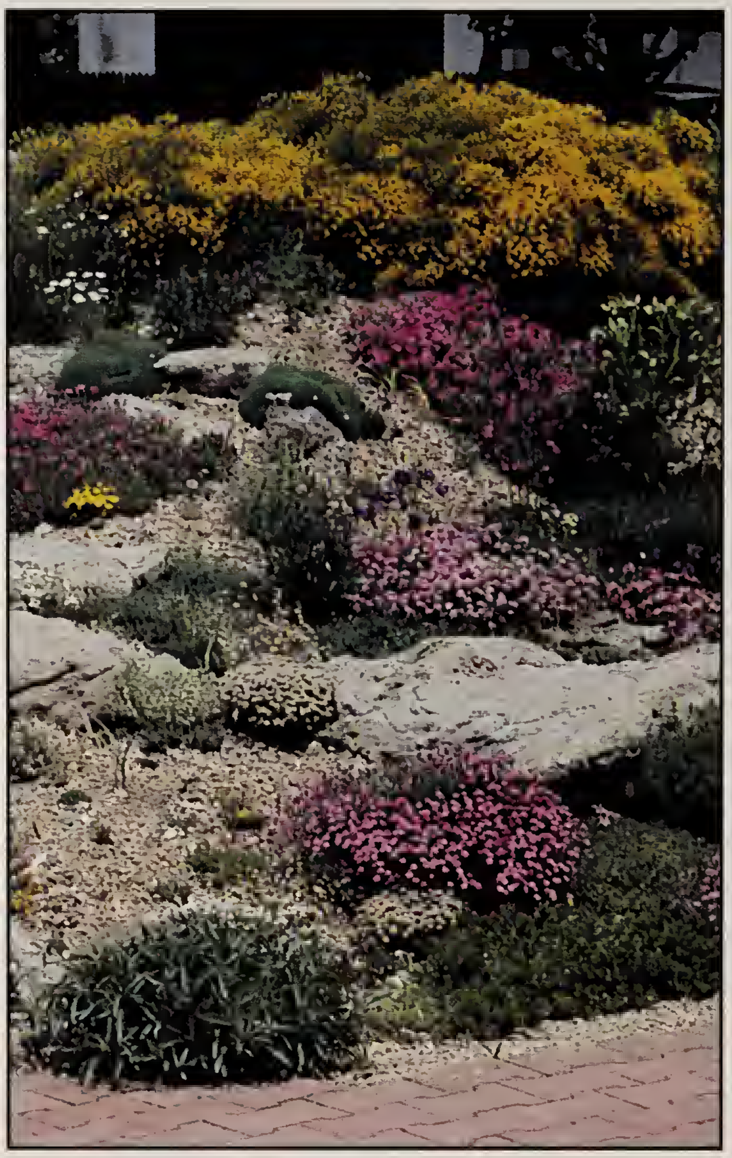
I have noticed dwarf conifers take about two years to establish their roots before they are rugged enough to tolerate our Colorado winters. It is not the cold temperatures, but the bright winter sun that desiccates a plant that is unprotected or does not have a well established root system.

I protected small trees by planting them in the protection of a rock where the low winter sun cannot hit them directly. When the trees grow taller and the winter sun can reach them, they will be well enough established to withstand winter desiccation.

Tucked into rock crevices, and mixed in among the heaths and between the little trees on the north slope of my garden are at least a hundred more kinds of plants. *Lewisia cotyledon* shows its pink flowers from the highest rock's crevice. *Arum italicum* sports several big arrow-shaped leaves along the sidewalk. *Astilbe chinensis* 'Pumila' regularly shows a wonderful soft pink spike every summer, a nice surprise since I seem to always forget it—the plant spends most of its time hiding in the green tapestry. When *Gentiana paradoxa* blooms its best blue in the late summer, I am very impressed with what Colorado gardening can be. *Cotoneaster microphyllus* f. *thymifolius*, *C. horizontalis* 'Little Gem', and *C. apiculata* 'Tom Thumb' usually show good red fall color. Their little branches provide winter interest, struggling to grow up and over rocks. In the summer they look like a tiny elf should be standing by.

Daphne cneorum var. *pygmaea 'Alba'* shows a mass of little white flowers each summer. *D. pontica,* has not done very much—perhaps it will after it has had enough time to develop. Its ultimate size should be one foot tall and one foot across. Big daphnes like *D.* x *burkwoodii* and *D.*x b. 'Carol Mackie' do very well in Colorado. Is there any reason why little *D. pontica* should just sit there?

All of my phloxes grow close to the ground—like a carpet surrounding the large furniture of rocks. During April the phloxes



Sandy Snyder

Genista (top), phloxes (left), pinks and columbines in the Snyder garden.

bloom and decorate the entrance for Easter better than I ever could. Purple- lavender- and pink-bloomers, they fill the southwest section of the garden. Last year a row of lilacs, *Syringa vulgaris,* just east in another garden was in bloom at the same time. It was possible to stand and look at the phlox covering the hill and, at the same time, the lilacs in the background. What a lively color combination they made. Each year species crocus and tulips add shades of yellow and white to the picture. Having it all backlit by the morning sun really announces the arrival of spring.

The south side of the garden is planted with cushion- and mat-forming plants. Among the ones I find especially delightful is *Dianthus anatolicus.* This favorite usually grows in a nice tight green mound. But as the plants get old and so large they cannot support themselves, they collapse in the center and take on other forms. One of my *D. anatolicus* has managed to position itself around a rock so that it looks like a snail with the rock as its shell. I have at least ten of these plants and each one has taken on its own personality. They never flower much, although I have seen pictures of them growing in pots in England with the cushion covered with so many tiny light pink flowers that the green cannot be seen.

I try to stuff the rock cracks and holes with sempervivums, sedums, rosularias and orostachys. Each year there are new favorites. But I never can give up any of the old favorites—such as the hens and chicks covered with cobwebs, *Sempervivum arachnoideum* or the round and soft *S. ciliosum* 'Mali Hat'. I have several little chasmophyte plants that try to help me turn the rocks into gardens. *Viola corsica* blooms ten months a year. It seems to spread everywhere but never takes over and looks like a small aristocratic purple pansy. *Talinum calycinum* sends its dark pink flowers up to sway on thin wirelike stalks and hops around, to grow in different cracks each year.

I love my garden because I don't feel that I must work in it. Small amounts of mulch applied twice a year eliminate endless hours of weeding: Pine needles, as many as I can get, mulch the north side; a top dressing of mixed squeegee, pea gravel and river stones covers the south side. The two mulches swing around the mound and meet each other and eventually they all mix together and blend.

My mountain garden is full of wonderful, small magical happenings all year and every year. But it reserves two shows big enough to stop people who usually drive by at 30 miles an hour. The *Genista lydia* on top of the hill is a large splaying plant every inch of whose low, arching, green branches is covered with sunny yellow flowers every spring. It makes Mount Snyder look like a volcano with hot yellow lava beginning to flow down the sides. In the fall the bright red *Zauschneria arizonica,* also planted near the top, makes the Mount Snyder volcano look as if it is exploding fire for a month. Come to think of it, this year I will plant more zauschnerias to make my fall volcano shoot even more fire.

Heaths for a Scottish garden in Colorado

Erica carnea 'Pink Spangles' flowers deep pink, January to April. Foliage bright green. Likes lime. The only true alpine. USDA Zone 6.
Erica carnea 'Sherwoodii' blooms rose-ruby January to April. Foliage light green. Likes lime. Zone 6.
Erica cinerea 'Alba' flowers white June to September. Foliage light green. Zone 6.
Erica cinerea 'Atrorubens' blossoms red-pink June to September. Foliage dark green. Zone 6.
Erica cinerea 'PS Patrick' blooms purple June to October. Foliage deep glossy green. Zone 6.
Erica x *darleyensis* 'Darley Dale' flowers pale lilac-pink November to April. Foliage deep green. Zone 6.
Erica x *darleyensis* 'Furzey' blossoms deep lilac-pink November to May. Foliage dark green. Zone 6.
Erica x darleyensis 'George Randall' blooms deep pink November to April. Foliage fresh green. Zone 6.
Erica x *darleyensis* 'Jenny Porter' blooms white November to April. Zone 6.
Erica vagans 'Alba' blooms white July-September. Foliage vivid green. Zone 7.
Erica vagans 'Birch Glow' blooms deep rose-pink August to September. Zone 7.
Erica vagans 'Miss Waterer' blooms deep shell pink August to September. Zone 7.

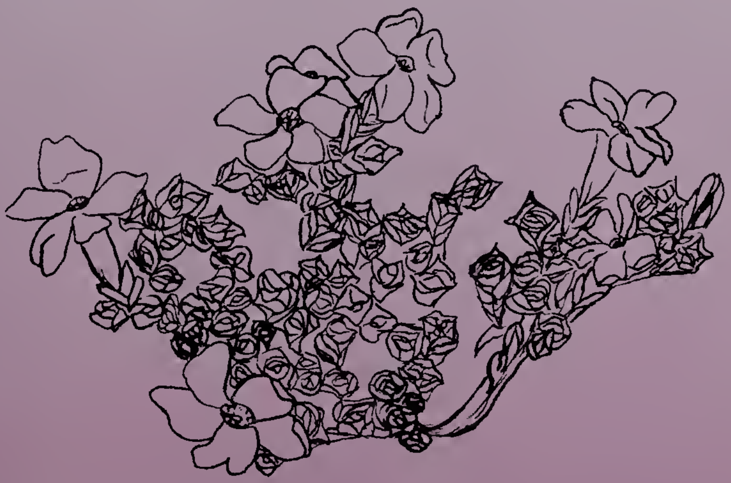
Note: The USDA Zone numbers are those *usually* recommended for these plants. The author has grown these in her Littleton, Colorado, garden, USDA Zone 4, for five years.

Dwarf Conifers for a Scottish Garden in Colorado

Chamaecyparis obtusa 'Densa', Zone 5.
Chamaecyparis obtusa 'Nana Gracilis', Zone5.
Chamaecyparis pisifera minima 'Golden Pincushion', Zone 5.
Chamaecyparis pisifera 'Plumosa Compressa', Zone 5.
Chamaecyparis pisifera 'Tsukumo', Zone 5.
Juniperus communis 'Echiniformis'.
Juniperus communis 'Pencil Point'.
Picea abies 'Clanbrasiliana', Zone 3.
Picea glauca 'Echiniformis', Zone 3.
Picea mariana 'Nana', Zone 2.
Picea abies 'Maxwellii', Zone 3.
Pinus mugo 'Valley Cushion'.
Tsuga canadensis 'Gentsch White', Zone 3.
Tsuga canadensis 'Husii', Zone 3.

Phloxes

Phlox bifida 'Betty Blake'
Phlox x 'Coral Eye'
Phlox 'Sneewittchen'
Phlox stolonifera 'Blue Ridge'
Phlox subulata 'Emerald Blue'
Phlox subulata 'Emerald Pink'
Phlox subulata 'Tardy Pink'
Phlox subulata 'Daniels Cushion'



Phlox bryoides, illustrated by Rebecca Day-Skowron

A Garden in Paradise

Bob Nold

Gardening in Colorado has the reputation of being a one-way trip to suffering and despair. The relative scarcity of ornamental gardens in and around Denver and the obviously abject surrender to high-maintenance lawn-worship seem to be symptomatic of the hopelessness with which most Rocky Mountain residents view gardening. After all, you can pay someone to mow a lawn and apply the various chemicals it needs, and watering can be done automatically.

Some hundred years after the fact, we still see our climate with the same agricultural perspective of 19th-century white settlers. We still think we're farmers waiting for rain that almost never comes. We still react with strongly positive, atavistic feelings to images of lush greenery originating from rainy parts of the world. This model of an "ideal world" of agriculture and, by extension, of gardening, has such a grip on our consciousness that the impossibility of achieving this ideal has robbed neighborhoods of considerable potential for color other than green— endless, unvarying and faceless green.

Preconceptions die hard, but they can be killed. Suppose that instead of stubbornly maintaining an "ideal" horticultural standard you change the standard's premises to allow the regional climate to formulate the model for you. Instead of having to water every other day to simulate rainfall, you experiment with drought-tolerant plants. Instead of staking gigantic perennials, you choose plants that like wind. Instead of pining for shade, you choose plants adapted to our intense sunlight. Instead of watering during a dry winter, you choose plants that prefer dry winters. A Nietzschean argument maybe, but gardening becomes much less anguish in the dirt and much more joyful discovery . . . and even happiness.

It was practically love at first sight when I unsuspectingly walked into the Rock Alpine Garden at the Denver Botanic Gardens. Expecting to find a large representation of typical rock plants, I found an amazing collection of mostly unfamiliar plants, and, especially exciting, dozens of familiar plants which weren't even supposed to grow in Denver. My mind immediately saw visions of superhuman efforts by the gardeners there, of mysterious horticultural practices carried out behind large rocks, and of having the extraordinary luck of building a public rock garden on the only spot in the state with a perfect climate.

Of course a model garden devoid of the usual deaths and blunders would be useless to everyday gardeners; they need experiences and practices which can be duplicated in their own gardens, even if on a smaller scale. When I saw dead plants in the Rock Alpine Garden I was relieved; when I saw these replaced with more unusual and possibly more suitable plants I was inspired. A static garden is a monument to boredom. To be interesting, a garden scheme needs to change, if not yearly, then at least gradually, so that we can see some thought is behind it all. A garden in which the same plants are

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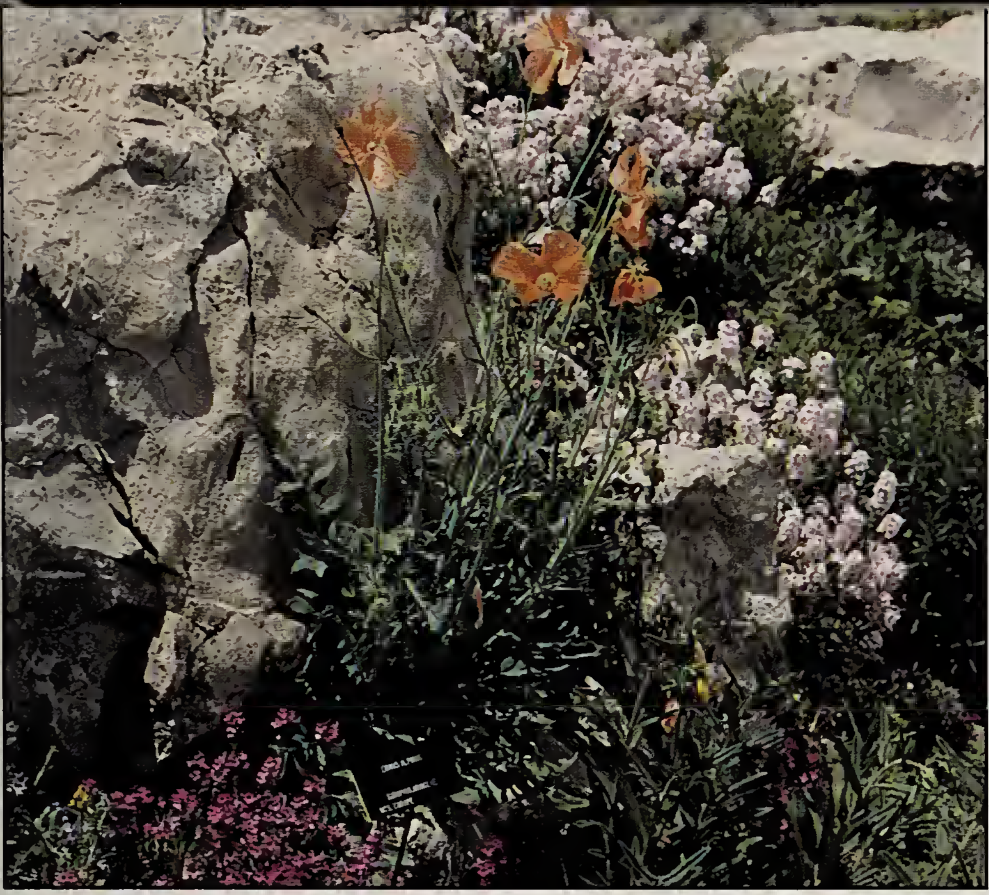
Lakewood, Colorado, gardener Bob Nold grows, with no supplemental water, one of the finest collections of dryland plants in the region. An employee of US West, he writes extensively for horticultural magazines.

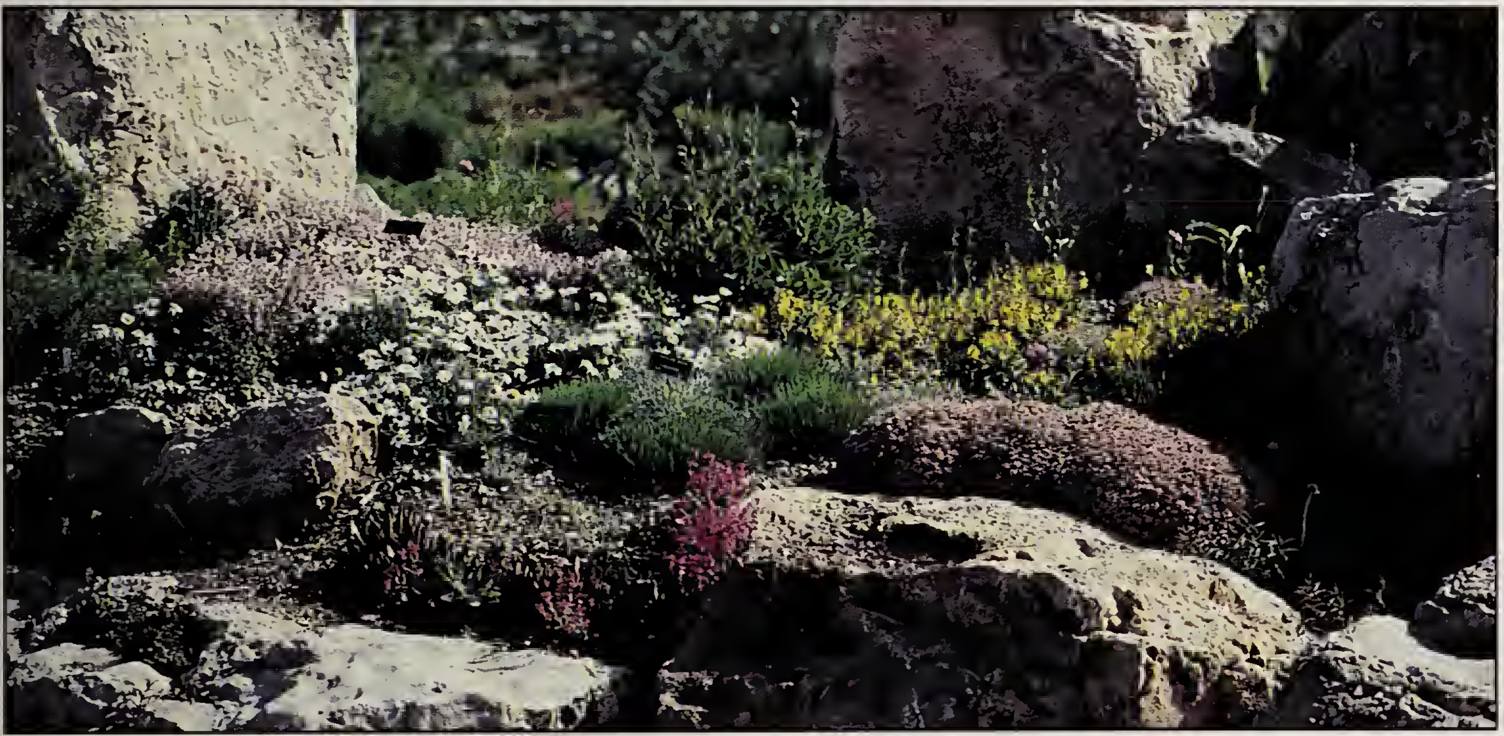
Panayoti Kelaidis



Top: Magenta *Erinus alpinus,* salmon *Papaver armeniacum* and pink *Aethionema pulchellum* in DBG's "lower meadow"

Bottom: In DBG's "limestone cliffs," left to right: lavender *Thymus camphoratus,* white *Chrysanthemum hosmariense,* magenta *Erinus alpinus, Ptilotrichum spinosum* 'Purpureum' and x *Celsioverbascum* 'Golden Wings'

Panayoti Kelaidis

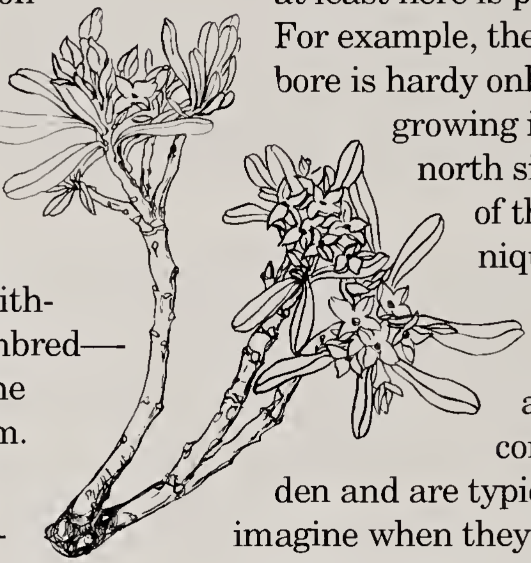


continually replanted is already dead. There was something going on here; the plant labels detailing country of origin were a hint.

What was happening in this garden, I think, was an attempt to realize the horticultural possibilities of our unique and mostly delightful climate, partly by seeing just how many plants could be grown and, partly, by exploring the largely unknown flora of global regions with a similar climate. As "traditional" rock garden plants inevitably died from the vagaries of our climate, they were replaced by natives and other exotics. As these plants thrived, more uncommon genera appeared, gradually altering the garden's overall cast.

It's difficult to describe the way a garden, or a certain part of a garden, impinges on the senses, especially since everyone experiences a garden in different ways. Some people will walk right past a planting others find entrancing; taste, orientation, knowledge and levels of interest vary. It's possible to suggest that the native shrubs, for instance, that dot the Rock Alpine Garden lend a distinctive Western feel to the garden, but only if they're recognized as natives. Even so, these shrubs (little leaf mountain mahogany, one-seed juniper, etc.) are odd enough to make very noticeable impressions on anyone who takes the time to really look at them. The woodland walk under the aspens has a feel vaguely reminiscent of Eastern woodland, but the feel of the "Tethyan" garden is something new.

Altogether new and a bit intimidating, here is a perennial border without the sense of artificiality and strain most borders have, the result of anachronistic ideas about the taming of nature, full as they are of the same old tried, true and tired high-water-demand plants. Most Colorado perennial gardens (I speak with the experience of ownership) look about as natural as hot dog stands on Mars: out of place, forced and full of grotesquely inappropriate plants. Here, though, is a perennial border where the plants have been chosen because they have their origins in homologous climates and their ability to withstand sun, drought, and wind are inbred—not because every gardener since the Dawn of Gardening has grown them.



The idea that you can actually have a garden in Colorado that represent mankind's perpetual struggle with the forces of nature may be a minor philosophical revelation, or maybe not. What is important is that at last you can have a garden without tears, without having to rush outside every half hour with a watering can, without having to "improve" the soil (the old 19th century creeping in again), without having the Poison Control's emergency number programmed into the phone. The essence of good gardening isn't in having the best tools, the most expensive urns on the patio, the fanciest Bulgarian hand-made hose guides, or knowing when to spray or prune, or knowing what color combinations are approved by authorities using criteria derived from climates where the sun shines for three minutes every fourth year, but in intelligent, practical plant selection.

Slowly, through the "trickle-down" theory of institutional horticulture, these Turkish salvias, exotic cornflowers and other fantastic plants are becoming available in nurseries and making Tethyan appearances in the gardens of the progressive, sophisticated, and individualistic.

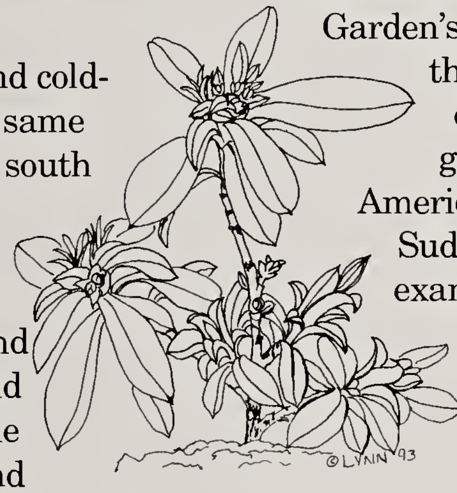
This garden leads us downward and inward to the Rock Alpine Garden proper, where only those free of envy and greed should tread.

The notion that some plants could be grown in Colorado despite dire warnings about instant death probably wasn't pioneered in the Rock Alpine Garden (advanced gardeners in the West had been experimenting with wildly unlikely subjects for many years prior to the first plantings at DBG), but at least here is positive proof for all to see. For example, the books say Corsican hellebore is hardy only to Zone 8, but here it is, growing in perfect bliss on the north side of a wall, without any of the special growing techniques many people insist DBG applies in secret.

The little plants, low and unassuming, form the core of any serious rock garden and are typically what other gardeners imagine when they think of rock gardening. Plants from high mountain tundra and windswept cold deserts throughout the world derive their huddled compact forms from living in extreme climates and are ideal for rock gardens, even though most of them don't grow in settings resembling rock gardens.

The "rock garden" as a format for alpine plants really is a fairly modern idea, and probably wouldn't have evolved into the stylish constructive art it is today if the original European proponents hadn't discovered that their wet climates demanded providing conditions that kept the foliage of alpines dry during the winter. Most alpines spend winters quite dry under a blanket of snow, and living in parts of the world where it rains in winter usually means a soggy death for the minuscule treasures, not to mention the concomitant fungal diseases and other troubles people forget about when they yearn for rain and humidity. Many alpines live tucked tightly into rock crevices in their natural homes, keeping their foliage and root crowns dry, so this technique has been replicated for many decades in Europe and damp parts of the U.S., but in Colorado, thanks to our dry, sunny, windy climate this isn't necessary. In fact many of these alpines whose cultivation so troubles other gardeners can be grown in ordinary soil with very judicious or even no watering. If the garden is irrigated, as you would expect any public garden to be, many of these plants thrive in conditions of the rapid drainage provided by gritty soil mixtures and full exposure to the sun, wind, and other drying factors. Since rain in winter is nonexistent, the protection devices (a pane of glass placed over the plants, etc.) used elsewhere are completely unneccesary.

Late spring frosts and the snowstorms that sweep down the Front Range from Canada are the bane of many a Colorado garden but alpines are unaffected by such weather, blooming through the snow and being none the worse for it. Like the native-plant gardener who is unbothered by summer drought, the alpine gardener generally remains in a state of bliss regardless of the weather. Many of these tiny plants are, believe it or not, quite hail-proof (if you think our spring weather in Denver is awful, try an afternoon hike above timberline) and, if damaged, usually recover quickly.



Alpine and tundra plants and cold-desert plants share many of the same characteristics; a hike along the south ridge of Loveland Pass will demonstrate this. Here are low, flat mats growing completely exposed in awful soil, gnarled and compacted by wind, sun, cold and drought. The soil is quite dry; the plants' roots go down forever, and frosts are possible almost any night of the growing season. Cold-desert plants such as those found at Pawnee Buttes have nearly identical features and growing conditions. They share the ability, in most cases, to conserve moisture with fine hairs on the leaves, sometimes to such an extent that the leaves appear silver or gray. These gray- and silver-leaved plants tend to rot if moisture collects in the hairs, so some of them are extremely sensitive to overhead moisture at any time. Some sections of the Rock Alpine Garden are subirrigated to subvert this. And while these plants are usually relegated to the alpine house (an unheated greenhouse-type affair) or to wistful yearning in rainy climates, they are perfectly growable in Denver.

The inability to grow moisture-sensitive plants caused European and American rock gardeners to explore other realms of gardening and other genera from wetter locales, so plant catalogs emanating from these areas feature wider ranges of moisture-tolerant plants and also some that demand considerable moisture at all times of the year. The result is that many gardens in wet regions tend to focus on these plants, and cold-desert plants from the American West, Turkey and Central Asia were neglected to the point where they received at most a footnote in a text. Many genera were practically unknown or, at best, represented by only a single species that happened to make the grand tour of individual gardens thanks to a cutting procured as a curiosity by an eccentric collector one morning on a forgotten peak many years ago.

The Darwinian (or was it Lamarckian?) drama of deaths and survival enacted out in the first few years of the DBG Rock Alpine Garden's existence pointed the way to these forgotten and ignored cold-desert plants and soon it was these genera, not the woodland plants of America and Japan, that drew attention. Suddenly the genus *Acantholimon,* for example, which heretofore languished under the rubric "alpine house only" (in other words, don't let them get wet), found itself as the object of adoration and wonder at the Denver Botanic Gardens and thence to local gardens where the many species have proved superb plants for the dry rock garden. Suddenly Western American alpines and plains plants found themselves coveted and preferred to the traditional rock garden plants such as primulas and "mossy" saxifrages.

The dry winters that are such a curse to local tree and shrub owners became a boon to alpine gardeners; now you could grow South African iceplants, even if you had to take ten years to adjust to that idea after having spent a Southern California childhood joyfully

On page 18: *Daphne arbuscula,* illustrated by Rebecca Day-Skowron
On page 19: *Lithodora oleifolia,* illustrated by Lynn Janicki

Now much in demand, zauschnerias and the Mexican phloxes were introduced as continental-climate plants and popularized by Colorado rock garden enthusiasts.

Right: *Phlox* 'Chameleon' and *Zauschneria garrettii* in the Heapes garden in August

Below: *Phlox mesoleuca* 'Arroyo' and *P.* 'Vanilla'

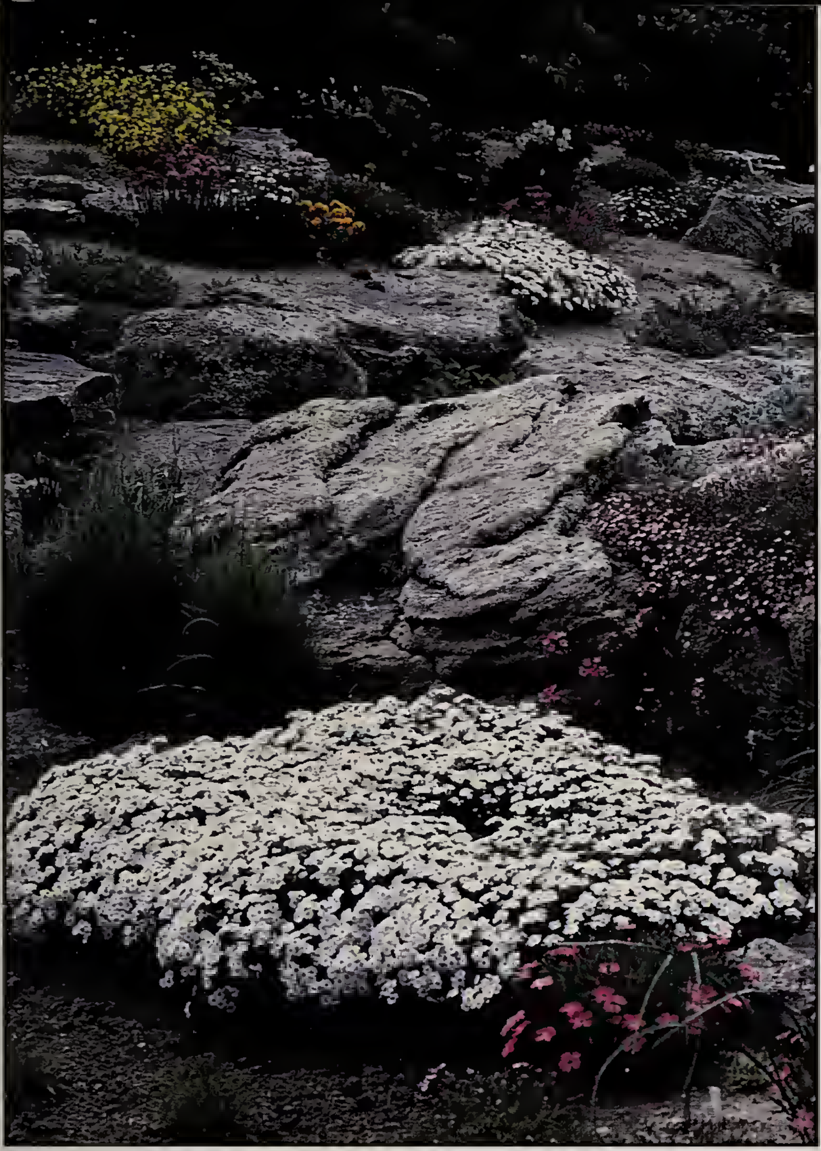
squashing them with your toes. The bulbs that rotted in rainy winters came up year after year, and we discovered that Denver had the best climate in the United States for growing anything like a wide variety of bulbs.

Dianthus and campanulas found an ideal home, and many Mediterranean plants whose hardiness was previously questionable flourished as though they had never read any gardening books. Our dry autumn weather allowed plants to stop growing and ripen in the sun, reinventing conventional notions of plant hardiness.

In fact, many alpine gardeners around the world are bitterly jealous of our climate and the growing abilities superbly demonstrated in the Rock Alpine Garden. (The situation is thus completely reversed from that of gardeners working with traditional plants.) Many rare and "ungrowable" plants find an easy life in Denver.

The extent of what we can grow is still unknown; floristic regions of the world with similar climates are not fully explored. Visitors to DBG may leave bewildered at the complex, multitudinous and unfamilar conglomeration of plants, but surely they can't fail to appreciate the glory and not-so-subtle message the Rock Alpine Garden whispers to local enthusiasts even in the gloomiest days of winter and even as the hail comes crashing down and the wind screams in our ears and the sun dries leaves to a crisp: We are gardening in paradise.

Robert E. Heapes



Achilleas and tulips are but two examples of the amazing wealth of plants from the Mediterranean region that thrive in Colorado's hot, dry continental summers.

Left: *Tulipa whittallii,* in the Coe garden

Below: *Achillea ageratifolia* in the Heapes garden

Bottom: *Fritillaria meleagris* in the Snyder garden

Clark Coe

Sandy Snyder

Urban Alpines

Ken Slump

The decision of two avid gardeners to forsake traditional yard and garden space for the "convenience" of town house living was not an easy one. Although we still enjoy what may be described as a small but typical front yard, other landscaping opportunities are restricted since the architectural design includes no garden area at the rear of the property. Our rooms surround a small, interior patio viewed on three sides by windows, the fourth side being the solid brick wall of our neighbor's town house. This intimate focal area sold us on this townhome's plan.

Having no yard, yet two large dogs, created an immediate dilemma. The townhome's accommodating builder was eager enough for a sale to sit down with us, the architect, and the contractor to devise a solution. The front yard of the complex slopes steeply up to the building. We determined to excavate an area for a dog run up near the front of our unit. It necessitated a retaining wall on the uphill side and wrought iron fencing on the front—an over-elaborate response, considering the area's purpose!

This construction removed most of the foundation plantings in front of our unit that had just recently been installed by the project's landscape contractor. It was not a tremendous loss. The plantings, although adequate, lacked imagination and diversity. The slate was now cleared to replant to our own satisfaction.

A prominent flight of steps climbs the hill to the front of the unit. The landscaper partially flanked the steps with a few very large boulders and installed the landscaping about them. This slope had also been a selling point for us; we envisioned an opportunity to develop it into a prime rockery. Two existing trees spared by the excavation process now became the backbone of an expansive new planting area extending across the front of the dog run and back up to the building.

This steep, dramatic slope challenged us to visualize a bold, strong design. We were anxious to maximize the limited space and realized that including many of our favorite plants would require an intensively planted landscape. A common thread was needed to unify the planting and give some emphasis to our front entrance.

To screen the dog run as well as create a landscape attractive in all seasons, we elected for a planting that relies heavily on the color, texture and form of dwarf conifers. Among the conifers we planted groundcovers, a few perennials and selected deciduous plants. Additional rocks and boulders were brought in to expand and enhance that aspect. Bulbs ranging from the fire engine red *Tulipa fosteriana* to the delicate bluish *Puschkinia scilloides* were tucked in to bring spring interest.

About a dozen dwarf conifers compose the design. Among them, vertical forms of dwarf Alberta spruce, *Picea glauca* 'Conica' and sentinel juniper, *Juniperus communis* 'Sentinel', contrast with the horizontal habit blue chip juniper, *J. horizontalis* 'Blue Chip'. The silver-blue needles of the blue globe spruce, *Picea pungens* 'Glauca Globosa' glow against the

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Ken Slump, a graduate of Colorado State University, maintains the Denver Botanic Gardens plant records. A former Denver city arboreal inspector, he holds a special interest in unusual trees.

rich green shades of bird's nest spruce, *P. abies* 'Nidiformis' and the nearby lawn. Fine-textured juniper foliage plays against the coarser textured spruce. A most successful component of the plan is a weeping Norway spruce, *P. a. 'Pendula'* which has grown to reach out from a rock outcrop to "shake hands" with visitors as they ascend the steps.

We incorporated a few broad-leaved shrubs into the scheme for seasonal interest. Dwarf winged euonymus, *Euonymus alatus* 'Compactus' was planted with the hope that its crimson fall foliage and symmetrical shape would blend with, yet complement the dwarf conifers in the autumn months. We situated two of the hardier evergreen rhododendron cultivars, 'Scarlet Wonder' and 'Ramapo,' near some of the large rocks with the expectation of exotic floral displays in the spring.

For the cause of "edible landscape" we planted a couple of Nanking cherry shrubs, *Prunus tomentosa,* that also provide some height and a background for certain conifers. Thus far robins have been the primary beneficiaries of the fruit. A grapevine trained onto the iron fence provides not only fruit but extra screening of the dog run in the summer.

We removed the landscaper's wood chip mulch and planted more than two dozen species of groundcover and perennial plants among the shrubs and trees for a more natural effect.

Our first filler plants included species and cultivars of *Veronica, Sedum, Phlox, Draba, Campanula, Aquilegia, Iberis, Thymus* and *Dianthus,* among others. Irregularly shaped plantings were executed in drifts between and around the shrubs and trees. "Filler plants" is a poor moniker for this group as they really gave the garden its seasonal spice and textural depth, especially in its early years. Spreading carpets of *Lotus corniculatus* and *Sedum kamtschaticum* soon rewarded us with their golden summer blossoms. The silvery foliage of *Lamium maculatum* 'Beacon Silver' and *Artemisia stellerana* added contrast that seemed particularly effective in the twilight hours. Carpets with subtle floral interest were also provided courtesy of: *Asperula gussonii, Antennaria parvifolia* and *Arenaria hookeri.*

Eight years have passed since our initial plantings, and some observations are pertinent. (I am always fascinated by the ways plants and gardens mature and evolve both because of and in spite of our best plans and efforts.)

The dwarf conifers developed into a handsome planting and are indeed striking throughout the entire year. They have grown and spread as hoped, some to the point of requiring judicious pruning to keep them under control. (*Warning:* The term "dwarf", as applied to conifers, is truly a relative term!) As the conifers, deciduous trees and shrubs expanded, many of the herbaceous plants were crowded out or eliminated. Some, I'm sure, completed their limited lifespans and disappeared. They filled spaces and flowered seasonally as the planting matured. Yet a number of the original species proved to be tenacious and long-lived.

Each April one section is still carpeted with the small blue flowers of *Veronica pectinata*. Spring also sees the return of a colorful succession of phloxes. Good performers include *Phlox* x *procumbens* 'Millstream,' *P. subulata* 'Scarlet Flame' and *P. douglasii* 'Boothman's Variety.' Another perennial that still makes an appearance is the cheerful dwarf Rocky Mountain columbine *Aquilegia saximontana,* and each fall I look forward to the violet-blue flowers of *Aster novi-belgii.*

A couple of the broad-leaved shrubs didn't work out. The first dwarf winged euonymus we planted grew nicely but never developed a hint of fall color. It seemed every November found this plant with emerald leaves clinging stubbornly to the twigs, while the same species next door had already shed its flame-red foliage. After several years I reluctantly removed the healthy, but non-performing specimen and replaced it with another, which died. The 'Scarlet Wonder' rhododendron also failed. 'Ramapo' is barely surviving. In spite of the difficulty in selecting and establishing rhododendrons in this climate, we persevere and this year added a reputedly super-hardy evergreen azalea 'Pot's Silver Pink' to the planting in a more protected but less conspicuous location.

Landscaping the patio area offered some tough challenges as well as exciting opportunities. The space, regrettably, is mostly paved but the architect left an oblong open area toward the southwest corner, i.e. the north side of a massive brick wall. The bed is large for an ornamental tree and a few carefully selected shrubs and herbaceous plants. Seeking an inviting scene appropriate to the shady site led us to use a woodland theme.

The protection offered by the building on all sides encouraged us to consider some species that tend to be marginally hardy in Colorado. At the same time, the plants had to be able to tolerate extra heat in summer that is reflected from the expansive concrete area.

For a small, flowering tree, we considered the usual options of crabapple cultivars, hawthorns, mountain ash and even flowering dogwood. We selected the interesting yet reliable redbud, *Cercis canadensis.* If I were making the choice today, I might opt for a more unusual species. Would the protected site sustain a Japanese snowbell, *Styrax japonicus*, perhaps a single-trunked fringe tree, *Chionanthus virginicus,* or possibly a Japanese stewartia, *Stewartia pseudocamellia*? Each would offer a variation of an exotic white inflorescence and are intriguing alternatives.

Beneath and near the redbud grows a curious selection of shrubs chosen for their variety of evergreen textures. Dwarf Hinoki false cypress, *Chamaecyparis obtusa* 'Nana'; 'Blue Prince' and 'Blue Princess' hollies, *Ilex* x *meserveae* cvs.; and *Rhododendron* 'P.J.M.', though hardly rare plants, display an unordinary visual melange. A specimen of redleaf Japanese maple, *Acer palmatum* 'Atropurpureum' is a personal favorite.

European wild ginger, *Asarum europaeum,* provides evergreen ground cover near the foot of the redbud. Two hosta cultivars, a hardy fern, a blue-flowered spiderwort hybrid, and violets mingle among the shrubs during the summer months. A few years ago, we cautiously added the much maligned bishop's weed, *Aegopodium podagraria* 'Variegatum', and thus far I am pleased with the way it fills between shrubs and appreciate the lightness its variegated foliage brings to an otherwise dark, shady bed. I rip out any parts that seem to be heading vigorously in the wrong direction. This restricted planting area provides the opportunity for using this invasive plant as the "right plant in the right place."

Lacking sufficient planting space in our "outdoor room," we turned to container gardening for additional greenery and color. Several large teak planters display deciduous and evergreen shrub and small tree specimens. I regretfully admit that over the years, numerous woody plants have succumbed as we attempted to cultivate "interesting" plants in these containers. Two of the container specimens continue the dwarf conifer theme of the front yard planting. A weeping Colorado blue spruce, *Picea pungens* 'Glauca Pendula', and weeping larch, *Larix decidua* 'Pendula', have survived in the wooden planters for years. Recently, we added two deciduous woody plants: Amur maple, *Acer ginnala,* for its orange and fiery scarlet autumn tints and Canada red cherry, *Prunus virginiana* 'Canada Red', for its burgundy summer hue.

Our rock garden bent is partially satisfied by a couple of trough gardens that augment the patio plantings. The troughs are great conversation items, especially during the summer months. One that includes several species of the genus *Sempervivum* was particularly effective last season. We usually add a few pots of annuals for summer display.

Our plantings have created desire among our fellow town house dwellers to augment and replant their landscapes with more distinctive species. Both of our adjacent neighbors have developed their public yard space into unique plantings that reflect their personal preferences, yet the shared elements among all the gardens result in a unified site.

We prize our small garden and appreciate the consideration we must give to each addition. We strive for selections that are not only the most effective in meeting the demands of design, but are also uniquely personal expressions of the beauty and diversity of plants.

Introducing Alpines Into an Established Garden

Clark Coe

As longtime members of the Denver Botanic Gardens, my wife and I have enjoyed following its gardens through the seasons, making use of its outstanding library and taking wintertime classes. Through all this, I became interested in rock alpine plants.

These plants were all new to me. One thing I liked was that their botanical names, rather than common names, were used so once these were learned, one could speak the language of rock gardeners.

In early 1988 I decided to grow them in our garden. Joy and I have been gardening in Denver for forty years. But suddenly we became puzzled how to introduce into the rather formal design of our perennial garden a naturalistic rock alpine garden, a miniature reflection of Denver Botanic Gardens' impressive Rock Alpine Garden.

I was particularly impressed with the plants that seemed very appropriate for small gardens. And I was drawn to the plants naturally suited to Colorado's climate, plants native to the mountains and high plains of our latitude around the world.

Many of these plants have long periods of bloom in addition to attractive foliage and growth habit. Most are evergreen or "ever-silver", providing four-season appeal.

Our Perennial Garden

Let's take a look at the southeast-Denver garden we dreamed to change, then 20 years old. Our perennial garden lies on the west side of our house. It has a central elliptical lawn surrounded by sweeping curves of perennial borders featuring irises, peonies, lilies and roses, a few broadleaf evergreens, flowering shrubs and small trees. A pleasing backdrop is provided by red oak, *Quercus rubra,* and two large Colorado spruces, *Picea pungens,* over the back fence. There are no trees in the lawn, which makes the entire garden seem larger.

From the living room patio one can survey the perennial borders, and the simplicity of design creates a tranquil feeling. But also one's interest is piqued to see the plants and flowers more closely. The view suggests a stroll along the borders—much to the owners' delight.

To introduce rock alpine plants into this scene, we concluded that we should get to know a goodly palette of them before making a major change in the character of the perennial garden. It would be best for a naturalistic miniature rock garden to come later.

The Wall Garden

The first prospective location for growing rock alpines in our garden was atop a three-foot buff sandstone wall that curves 30 feet out into the lawn to define the separation of the sloping upper portion on the north from the level lower portion to the south. The wall gradually becomes lower and ends where the two lawns meet. Part way along the wall, steps provide access between the lawns.

A native of North Dakota, Clark Coe wanted to be a landscape architect, but he earned a business degree from the University of Colorado at Boulder and devoted his career to the late Frontier Airlines. His devotion to gardening is accompanied by interests in photography, travel and classical music.

We decided to begin by removing a strip of grass and creating a rock alpine bed atop the wall, six feet wide at the patio, curving to three feet at the steps and narrowing gradually to the lower end of the wall. In early spring 1988 we prepared the soil, selected the plants and planted them.

My new interest in rock garden plants was paralleled by a new attraction to dwarf conifers, which I first saw at Paulino Gardens, a nursery in northern Denver. I became excited about them after a rock garden society slide lecture by the prominent grower of dwarf conifers from Iseli Nursery of Oregon.

So a few dwarf conifers were included for variety and interest. Among the ones we now have, I am most fond of a mugo pine, *Pinus mugo* 'Iseli White Bud', an Eastern white pine, *P. strobus* 'Macopin', and a Colorado spruce, *Picea pungens* 'Glauca Globosa' in the wall garden, and a Yugoslovian spruce, *P. omorika* 'Nana' and another Colorado spruce, *P. pungens* 'St. Mary' elsewhere in the garden.

We think the new wall garden is successful, not only because the plants are thriving and much enjoyed, but also because, when you now view the entire perennial garden from the living room patio, the wall garden makes a quiet visual impact and arouses your interest without overwhelming the rest of the perennial garden and without destroying the feeling of unity and tranquility of the original garden design.

The South Garden

Around the corner from the perennial garden, on the south side of the house, there was an unwatered area 13 feet wide and 30 feet long, where a large curly leaf mountain mahogany, *Cercocarpus ledifolius,* a bigtooth maple, *Acer grandidentatum,* and a thornless honeylocust, *Gleditsia triacanthos 'Inermis',* grew with underplantings of *Vinca minor, Euonymus fortunei* 'Kewensis' and volunteer Oregon grape, *Mahonia aquifolium.* There, between a sandstone path and the house, we built a buff sandstone planter 2 feet wide and 18 feet long with well-draining soil for dryland plants, all to be infrequently hand-watered. Several eriogonums from the West are there with acantholimons, drabas and sempervivums from the eastern Mediterranean through south-central Asia. Even our local harebell, *Campanula rotundifolia*, is a better garden plant there with less water.

Clark Coe

Erigeron chrysopsidis 'Grand Ridge'

Clark Coe

Veronica thymoides ssp. *pseudocinerea*

South of the walk we created a sunny 7 feet by 9 feet bed for phloxes, penstemons, veronicas, aethionemas, sedums and like plants that need to be watered more often. A dwarf Cedar of Lebanon, *Cedrus libani* 'Nana', and miniature mugo pines, *Pinus mugo* 'Paul's Dwarf', add contrast. And last, in the dappled shade of the honeylocust, are two small beds for *Lewisia cotyledon* and other plants requiring some shade.

The four beds of the new south garden are a satisfying addition because they create a surprise around the corner from the main perennial garden, while providing a place for rock alpines that want drier conditions.

Wild Tulips

Both the south garden and the wall garden spring to life early in the growing season with several varieties of small, short-stemmed wild tulips native to Turkey, Iran and beyond. This part of the world is the source of the tulips that the Dutch have hybridized over centuries to achieve the great array of large-flowering bulbs so popular today. But the little wild ones are just the right scale for the rock garden and are equally delightful.

Among my favorite wild tulips are the royally magenta *Tulipa pulchella* 'Persian Pearl', the rich orange and pale buff *T. whittallii,* the sulfur yellow and orange-edged *T. batalinii* 'Bright Gem', and *T. montana,* a rich red.

Love Affair

Now that we have lived five years with rock alpine plants and dwarf conifers, I must admit that I am surely in love with both of them, but don't want to turn my back on our bearded irises, peonies, lilies, roses and other standards. And I haven't even mentioned my recent fascination with small-leafed rhododendrons. But I believe that there simply is no end to the number of plants that dedicated gardeners can love!

Ten of My Favorite Rock Alpine Plants

Erigeron chrysopsidis var. *brevifolius* 'Grand Ridge', a gray-green cushion with long-blooming chrome yellow daisylike flowers, from the Wallowa Mountains of eastern Oregon.

Daphne arbuscula from the Carpathians of Slovakia, a tight little shrub with glossy dark leaves and fragrant deep pink flowers that appear twice a season.

Veronica caespitosa from Turkey, a tight ever-silver mat covered with tiny blue flowers in spring.

Two *porophylla* (Kabschia) *saxifrages* originally from the Alps to the Himalayas, *Saxifraga* x *hornibrookii* 'Ariel' with miniature wine red trumpets and *S. burseriana* 'Princess' with small white cup flowers, both on precise little green cushions.

Dianthus microlepis, a dense green bun with vibrant pink flowers, from the Balkan Mountains of Bulgaria.

Lithodora oleifolia, with gray-green foliage and clusters of delicate blue trumpets, from the Pyrenees of Spain.

Asperula gussonii, with clusters of minute pale pink stars on low spreading mats, from the mountains of Sicily.

Androsace lanuginosa from the Himalayas, soft green dense mats that bear clusters of light pink flowers with red eyes.

Geranium dalmaticum from the Dalmatian coast of Yugoslavia, with rich pink flowers on a perfect green mound of small geranium leaves.

Jerry Morris: Colorado 'Broomer'

Susan Eubank

How far away from the house or the walk is your Colorado spruce, *Picea pungens,* planted? Mine, a 12 foot specimen, is planted within three feet of the back porch. A horticulturalist told me the cost to move it to a more appropriate site would be much more expensive than what the tree is worth. Now I can only see it as a potential Christmas tree.

The inappropriate use of trees in the residential landscape is one of the many reasons Jerry Morris, Colorado arborist and landscape consultant, developed a passion for dwarf conifers and witches' brooms.

His interest began in the 1960s hiking through the Rockies in search of elk and fish. He's not a roadside sportsman, so he has covered many miles in the back country. He became curious about the odd branches he remembers seeing first in a tree near the old highway to Evergreen, Colorado.

What were these odd, tightly-compacted growths? In a 1967 article in *Arnoldia,* publication of Arnold Arboretum, Alfred J. Fordham describes the European origin of folklore about these unusual growths called witches' brooms. The term describes various kinds of stunted growths on woody plants caused by insects, disease or genetic mutation.

During medieval times these growths were thought to have protective and healing powers. Witches, as well as other spirits such as elves, hobgoblins and "mares" (as in nightmares) used them as nests and resting places. They were also used by witches for transportation. The "broom" appellation comes from their resemblance to a bundle of twigs used for sweeping.

With many more wanderings through the mountains of Colorado, New Mexico and Wyoming, Morris grew to understand the natural history of some local conifer witches' brooms. He has found brooms of every species of native Colorado conifer.

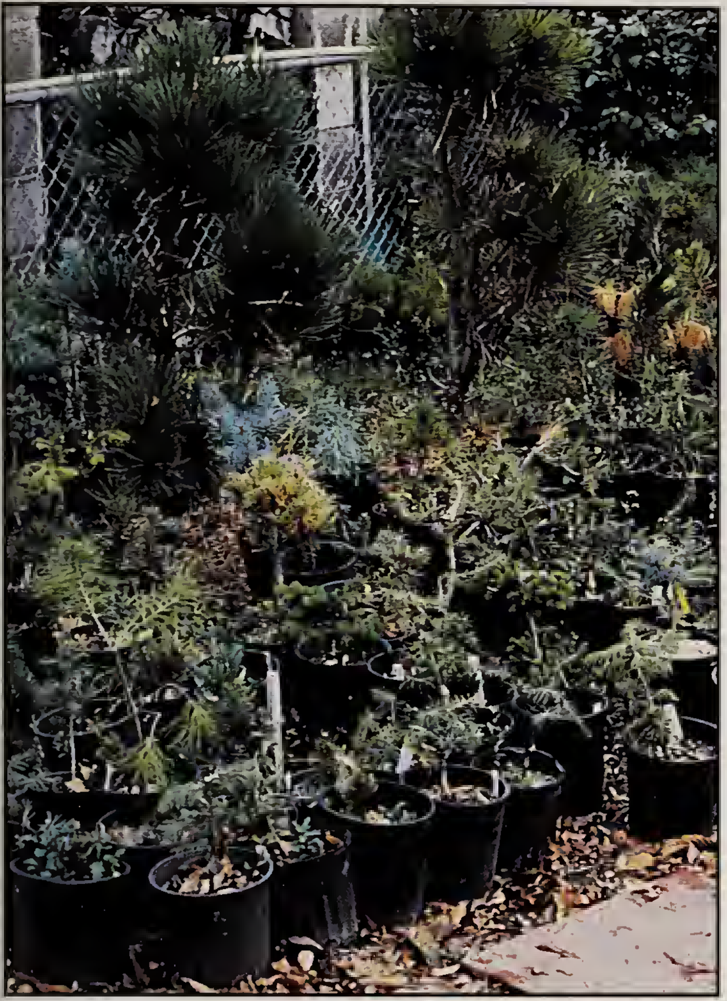
After many years he began noticing patterns in the sites in which they are found: Trees with witches' brooms are usually in rocky drainages that run northwest by southeast. If the canyon meanders, wherever it coincides with the northwest to southeast axis, those slopes are the most likely place to have brooms. Amazingly, either side of the canyon is a possible broom site, without any preference as to north or south slope. They don't typically grow on the canyon bottom, and if the valley is too wide, the canyon sides are no longer a suitable broom site.

Once he finds a specimen, Morris carefully documents the site with a map and gives each individual tree a name. In order to relocate the specimen, the name usually references a geographic site, such as *Picea pungens* 'Rifle Gap', which is located north of the town of Rifle, Colorado, or *Pinus flexilis* 'Damfino', on Damfino Creek near Walden. At particularily rich sites, trees get metal tags above the snowline to remind Morris of its location and name. Even the city of Denver has its own witches' broom population, which Morris has carefully documented.

This sounds like a lot of work, but locating the witches' brooms (and elk) is only part of the fun. He then collects cuttings (scions)

Susan Eubank, associate librarian in DBG's Helen Fowler Library, volunteers in the Rock Alpine Garden and enthusiastically gardens at home.

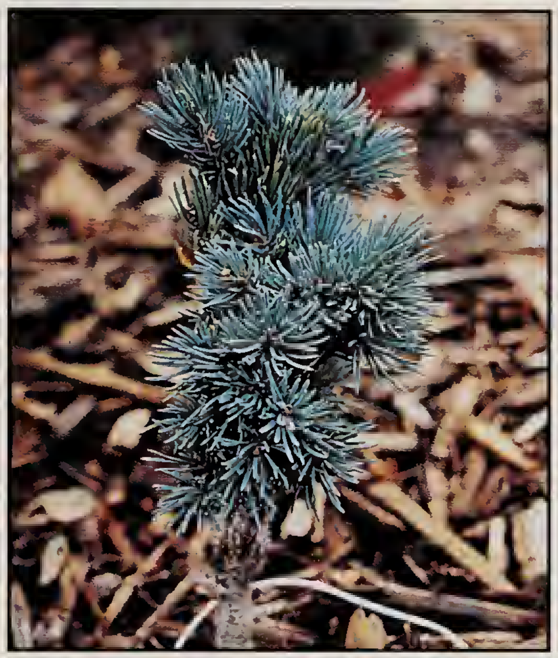
Clark Coe



Left: Jerry Morris' grafted-conifer nursery

Below: One of many of Morris' brooms: *Picea engelmannii* 'Pinkham'

Clark Coe



and seeds and uses these to produce hundreds of progeny of the various forms.

He regularly exchanges scions with about 10 other "broomers" through the American Conifer Society. The seed goes into the ACS seed exchange. Does the Colorado nursery trade need a very slow-growing columnar blue spruce whose branches shed snow because they grow horizontally rather than in the upright fashion of the usual fastigate conifer? Joe Stupka, broomer and nurseryman in Pennsylvania, is just starting production of such a tree. He had previously lost his stock plant. Then he found a specimen in a front yard about 30 miles from his home. After the homeowner generously let him take cuttings, Joe offered to buy the tree but the owner refused, saying he liked it very much and had purchased it from a short, young nurseryman about 25 years ago at a nursery up the way about 30 miles. Stupka recognized his own description of younger days. Jerry Morris received cuttings ("wood") of this one too.

With his many years of grafting experience, Morris has developed techniques for grafting all year-round. In the winter the grafting just moves inside. In July he takes his specimens up to the mountains and makes sure they are in the dripline of the north side of his cabin. He constructs miniature greenhouses—needed so the graft doesn't dry out—encasing the whole plant, pot and all, in a couple of plastic bags.

Another source of Morris' plantings are seeds. Witches' brooms sometimes produce viable seed; wind-swept, tree-line environments sometimes produce genetic dwarfs; and abandoned nurseries of field-grown plants are always a good source of genetic oddities. He starts his seeds with 24 hours of light; heat and within two years the plants have produced five or six flushes of new growth.

Morris has some favorite plants: *Pinus ponderosa* 'Stoney' is 15 feet tall by about 30 feet wide. The trunk is 20 inches in diameter. It has dropped all its lower branches up to 5 feet and the branches are very twisted. It's a beautiful natural bonsai.

In southern Colorado he found a dwarf one-seed juniper, *Juniperus monosperma.* It's about 4 feet high by 7 feet long and 4 feet wide. Unlike the usual one seed juniper the foliage is a very bright green. For many years Morris tried to get grafts to take but had many failures. He sent out wood to the other broomers and just this year, he heard that they had produced some successful grafts. This winter he finally got some of his to take also.

There's a limber pine, *Pinus flexilis* 'Saunny', up in southern Wyoming that is about 16 inches high and 30 inches across. Its needles are shorter than the species and bright silver-green. The tree really stands out on the mountainside. Morris speculates from counting some rings on a dead branch, that the tree is over one hundred years old. During the winter of 1989-90 the elk took 20 or 30 years of growth for dinner, but in the spring of 1990 the tree had a new flush of growth and seemed healthy. That fall Morris saw the elk again and decided to protect the tree with hog wire. Now its grafted scions are doing well.

He also believes he's found Colorado's oldest dwarf conifer. At about 11,000 feet in the Rockies, the 12-foot bristlecone pine, *Pinus aristata,* with thick, vigorous, and very attractive foliage is a genetic dwarf with a ring count of 667 years at the four-foot level.

Pinus flexilis 'Cherokee' and *P. f.* 'Damfino' are beautiful examples of dwarf conifers. 'Cherokee' is a very low bird nest shape with a very bright blue-green color. It grows about 2 inches a year. He has one that is 5 years old and is about 14 inches in diameter. 'Damfino' is more upright. It's a very deep, dark green. His oldest example is 10 years old and about 30 inches tall and 20 inches wide.

What does Morris hope will happen to all these dwarf and slow-growing Colorado natives that he is propagating? One ambition is to find someone with enough land to plant 100 different forms of a single species. He has at least that many each of bristlecone pine, limber pine and Colorado spruce. This unusual arboretum would be a good testing site to watch the future growth of the forms. In 10 years it could be a formidable display of genetic variety. He also believes these many different varieties should be pushed into the steppe climate nursery trade.

Join Us For Fun!

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For those plains and montane areas that receive less that 20 inches of rain a year, the dwarf conifers developed in Europe, the eastern United States and the northwestern United States are challenging to grow. If Morris' Rocky Mountain witches' brooms became standard local nursery stock our gardeners would have evergreens that require little water or maintenance. Slow growing, they would be beautiful accent plants to use along walks, as foundation plantings and in spaces too small for standard 100-foot specimens.

Jerry Morris came to pursue his passion while working his way up through the tree service industry. While working in the 1970s for Rocky Mountain Tree Experts (a company he later owned) Morris showed his dedication to Colorado native conifer species with his work on the Denver Botanic Gardens' Chatfield Arboretum. The Arboretum was so new the landscaping existed only in plans. In order to push the plans into some tangible reality, Morris suggested that some ponderosa pines could be planted at the entrance gate. The site was not irrigated. He studied the site at the gate of the Arboretum and situated the pines at the low point of a small slope near the entrance. He then dug channels following the contours so that any water on the slope would be directed to the pines. six-foot to 12 foot specimen trees were planted and watered in. Once, in the hottest part of their first year, he brought the watering truck and directed some water down the contour channels. In subsequent years, no irrigation has been necessary for every tree to survive.

Do you want to help? Call Jerry Morris at 303 234-0780.

Alpines from Scratch

Kirk Fieseler

I first became interested in rock gardening while visiting the Rock Alpine Garden at the Denver Botanic Gardens eight years ago. The curator, Panayoti Kelaidis, was busy planting some small seedlings, but he took the time to introduce me to some of his treasures. For some reason everything clicked at that moment and I became aware of this beautiful marriage of rocks, water and plants. Or in simpler terms, I started to dig rock gardening.

The best way to enjoy rock gardening is to take an active role in all its aspects, from building and planting, to seasonal maintenance. Unfortunately, I have yet to find the time to do all this. I am too busy producing plants to build my own garden. I think my horticultural background at production-oriented Colorado State University and my growing up in crop-dependent Iowa led me to the nursery (growing) side of rock gardening. I have this habit of measuring my life in terms of past crop seasons and my future in how many I have left.

Patience is probably the greatest virtue of a plant grower, especially if you are interested in propagating dwarf conifers and alpines of the Rocky Mountains. My first crop of bristlecone pine, *Pinus aristata,* was seeded in 1980, and this year I will harvest and, hopefully, sell 40 36-inch individuals from that seedling year. I also grow *Picea pungens* 'Montgomery' by grafting. These grow much faster and I can produce a four-gallon plant in only eight or 10 years. My mortality rate is very low, not more than 40 percent. Even many of the herbaceous perennials and alpines grow slowly. I have some sego lily, *Calochortus gunnisonii,* that consist of a one-half-inch diameter bulb and a three-inch tall blade of grass for three months out of the year. These are four years old now. Many of my petite alpines (*Primula angustifolia, Saxifraga caespitosa,* and *Lewisia pygmaea*) are perfectly happy in their 2 1/4-inch pots year after year. Patience and learning from mistakes are important in the world of plant production.

My growing facilities consist of two unheated greenhouses (30 feet x 50 feet), two large lath houses and approximately one-half acre of sand plunge beds. Most seeds are sown in four-inch pots during the winter months and placed in an unheated greenhouse to experience natural vernalization periods. I begin transplanting the seedlings into 2 1/4-inch plastic pots in mid-May. These transplants are left for one full growing season before they are available for sale.

Plants are overwintered in the same unheated greenhouse on the ground and nestled in sand. Most alpines seem to do better if kept on the dry side throughout the winter. My growing mix is very simple: one-third each of perlite, sand and sphagnum peat moss. I fertilize with a general liquid fertilizer (20-20-20) every four to eight weeks throughout the growing season. Pests are always present but seldom harmful. I do seem to have problems with slugs (liquid slug bait works great) and fungus gnats (I use Gnatrol, a

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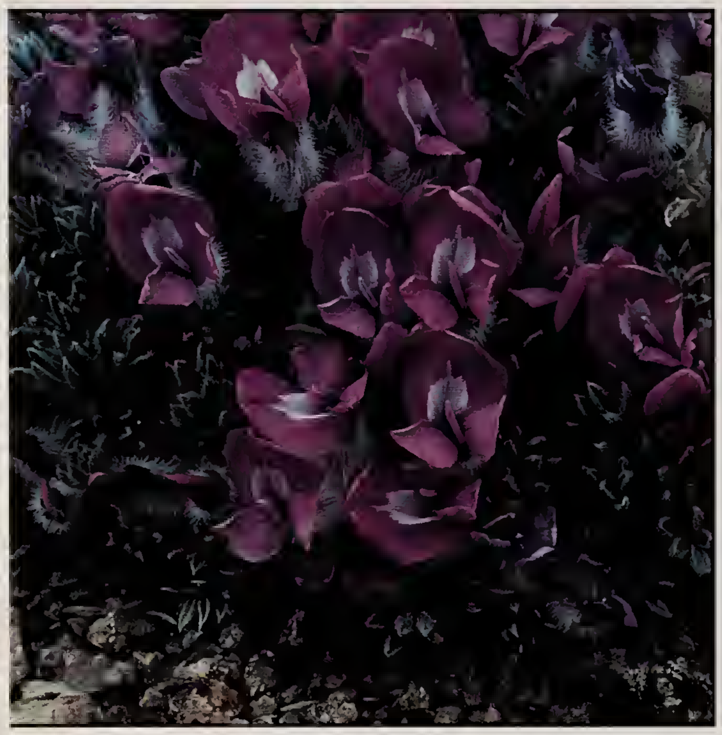
Kirk Fieseler is director of the horticulture program at Front Range Community College North, Fort Collins, Colorado. He owns and operates LaPorte Alpines, a mail-order source of choice plants.

Right: *Primula parryi* in Pingree Park, Colorado

Below: *Oxytropis multiceps* on Laramie Pass, Colorado



Kirk Fieseler

Bacillus thuringiensis product). Of course, both problems are due to excess moisture. Unfortunately, this is a problem that's difficult to eliminate in a greenhouse.

Most of the seed I use, I collect in northern Colorado and Wyoming. I collect very small amounts of seed which I usually get cleaned and stored away in empty film canisters by Halloween of the same year. Seed pots are kept for two growing seasons before I discard them, but because I reuse this soil I am constantly being surprised by some tardy seedling showing up in the most unexpected place. I just replant them in their own pot and put them in a "hodgepodge" flat.

Cuttings and separations are also used to produce many kinds of plants such as dianthus, saxifrages, phloxes, veronicas, silenes and androsaces. Most cuttings are taken in July and August and placed in a very simple mist bed until they are rooted. Close watch must be maintained to remove cuttings promptly after rooting starts, because cuttings will rot quickly if left too long in the mist system. I find rotting a very common problem in rock garden plants. A fungicidal drench would probably overcome this problem, applied when the cuttings are first stuck. I do not use hormonal or fungicidal dips when sticking cuttings, but I may start soon.

When to take the cuttings, or "timing," is probably the most important factor in propagating difficult-to-root herbaceous plants. Determining when the physiological condition of the cutting is prime for rooting to occur depends on many factors: seasonal growing environment, light, temperature, photoperiod and growth phase of the mother plant, active growth, flowering and dormancy. It takes some experience to be able to take advantage of this window of rootability. I don't care how green your thumb is or how much rooting powder you use, if your timing is off, you will have poor rooting results.

Some successes with growing rock garden plants have been achieved with benign neglect. Usually, the more I coddle a plant species—give extra lime, provide a gravel collar, give extra water—the less successful I am at growing it. Generally, I follow these simple guidelines:

Provide a well-aerated soil.

Provide a well-ventilated site.

Protect plants from direct hot sunlight.

Keep plants on the dry side when not in active growth.

Use low amounts of fertilizer.

Don't look at poorly growing plants too often.

Change the growing conditions of poorly growing plants the following year.

Listed below are some plants that I have had some luck in propagating and growing. All are Colorado natives.

Arenaria hookeri This prickly bun of a sandwort has a very long blooming period when cultivated. I propagate this plant by taking cuttings in early April from stock plants that have a very tight growth habit. About 60 percent of the cuttings root and it takes a long time, usually two to three months. Seeds are easy to germinate, but much height variation exists.

Astragalus spatulatus Large flat (three-inch diameter) pads of grayish-green foliage characterize this plant. Seeds germinate easily if given a quick rub between two sheets of sandpaper before sowing. Cuttings can also be rooted if taken early in the spring. This plant is difficult to grow once transplanted; plants seem to languish if kept too wet and hot. They need excellent drainage and good air movement.

Dryas octopetalata Large, white roselike flowers and shiny crinkled oaklike leaves give this alpine great ornamental value. Seeds are easily germinated if given vernalization and thoroughly mixed into soil media during sowing (typically, seed germination percentages are low). Cuttings will root if stuck in midsummer. Keep on the dry side after active growth has stopped.

Gentiana affinis Six- to eight-inch stems bear many dark purple tubular flowers that remain almost closed throughout their blooming period. They are very easy to reproduce by seeds; germination percentages are usually high. This is probably the most easily grown of all the native gentians.

Hymenoxys acaulis This is a dwarf, clump forming plant with hairy basal foliage and bright yellow miniature sunflowers. It's easy to germinate but difficult to grow once transplanted into 2 1/4-inch pots. Keep on the dry side, cool and well ventilated.

Oxytropis multiceps A xeric bun plant with fuzzy, gray-green foliage and abundant purple flowers both in the spring and fall. Seeds need a scarification treatment (sandpaper works well) before sowing. Germination percentages are usually quite high and seedling growth is rapid. Keep dry after transplanting or rotting will occur. Give plants full sunlight and plenty of fresh air.

Phlox bryoides This plant has very condensed, grayish foliage and produces delicate, fragrant white flowers in early spring. It is found growing on limestone outcrops. Seeds germinate, but in low percentages. Seedlings grow very slowly and resent wet, humid conditions. I have never been successful in rooting cuttings.

Primula angustifolia This is a dwarf alpine that grows in the shade of boulders on rocky peaks. It produces magenta flowers with yellow centers. Small green seeds germinate readily and in high percentages. Seedlings grow slowly and should remain in seed pots one entire growing season before transplanting. Don't expect flowers until the second or third spring after transplanting.

Primula parryi This plant consists of tufts of narrow, 10-to 12-inch tall leaves with flowers that are bright reddish purple with yellow centers. The entire plant has a distinctive odor to it. Seeds germinate in fairly low percentages. Resulting seedlings are slow to establish themselves and should be left in seed pots for most of the first growing season. Provide plenty of moisture when growing but withhold water once the plant starts to go dormant, and keep on the dry side throughout the winter.

Saxifraga flagellaris As its common and botanical names suggest, this plant spreads by runners. It is easily propagated by separating rosettes in early spring. Older rosettes die after producing brilliant yellow flowers, but send out numerous plantlets before doing so. Provide a gravelly soil and good air movement.

Prairie Smoke

Andrew Pierce

Trios of small, rose-colored, nodding flowers on foot-high stalks is a deceptively simple description of prairie smoke. A plant of many names, it also goes by "pink plumes," "grandfather's beard" or "Apache plume." And as with many geums, its botanical name has varied: Currently—locally—it is *Erythrocoma triflora.*

Whatever you call it, it is an attractive plant to grow in a "wild" garden with little water. In rock gardens that receive more moisture it tends to be short-lived.

According to one source, "The Indians boiled the roots to make a beverage. It tastes very much like weak sassafras tea."

In the wild, from the foothills to high in the montane zone, it is sometimes overlooked, as it often grows among grasses in gravelly locations. Its finely dissected leaves, somewhat typical for the geums, appear very early in the spring as bright green rosettes. The flower stalks follow in summer.

What we call "smoke" or "whiskers" are feathery extensions of its seeds, similar to those of pasque flowers and wild clematis. By August these rose-pink plumose clusters have changed to creamy white and are dispersed to other locations by the wind. At this stage its leaves are just tinged with red; after the first light fall frosts they turn bright red, like the plant's cousin *Acomastylis (Geum) rossii,* late in the season the most brilliant color-maker of our tundra.

DBG plant propagator Andrew Pierce's superb garden in Evergreen, Colorado, has been the subject of articles in magazines worldwide.

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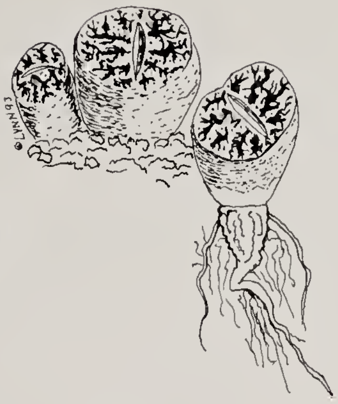

Lithops lesliei,
illustrated by
Lynn Janicki

Mary Ann Heacock

It was never my intention to test lithops for winter hardiness. I tumbled into it or, more accurately, I was pushed into it.

In May 1983 Panayoti Kelaidis gave me a small plant of *Delosperma nubigenum* which had proved to be hardy in the Denver Botanic Gardens Rock Alpine Garden. It thrived, and later I received a plant of the purple-flowered *D. cooperi.* It too thrived and I gave cuttings to all who would accept them.

Paul Heiple who lived in Golden had been growing and testing mesembryanthemums for winter hardiness with great success. He shared with me plants of *Aloinopsis spathulata, Stomatium suaveolens, S. fulleri, Delosperma sutherlandii,* and *Neohenricia sibbettii.* All of these proved to be winter-hardy to a marked degree.

On August 15, 1990, I was given 60 assorted mesembryanthemums to test. These had been grown by Kelly Grummons from seed purchased from Mesa Gardens. Although it was late in the season to establish plants, I planted them in a raised bed with an eastern exposure using porous soil with plenty of small gravel for drainage. During the winter months there was a fair amount of snow cover and the bed was exposed to the full blast of north wind. In the spring of 1991 I found the survival rate to be better than I had expected.

In June 1991 Grummons gave me 20 more mesembs to test. I shuddered when I saw eight of these plants were lithops! Surprisingly six of these came through the 1991-1992 winter and by the end of December 1992 five were alive and doing well. The sixth species, *Lithops hallii* 'C174', had been alive and happy during the early fall so I suspect birds may have gobbled it up. Too, it could be the plant had withdrawn into the soil and could not be seen.

Lithops are great mimicry plants. The name comes from the Greek "lithos" meaning stone and "ops" meaning the appearance or face so the common name of "stone faces" is appropriate. The plants are attractive to birds and although I have a top dressing of small stones and rocks, birds with keen eyesight and sharp beaks can quickly devour them.

Lithops are South African succulents which have developed thickened leaves with windows at the end of or on the face of the leaves. A thickened taproot with radiating fibrous roots help the plant to survive under harsh temperatures and drying winds. When grown in our gardens or greenhouses a light misting or spraying of the tops seems to stimulate root development. The plants absorb the water through their epidermis. It is not wise to soak the plants as this could induce rotting.

Lithops are easy to grow from seed. The seeds usually germinate in three to five days and requires good light and air circulation. Within each species there is a wide variation in color and markings to the extent it appears to be several different species growing in each individual seed flat.

The five species which have survived and thrived are: *Lithops fulviceps* 'C170', *Lithops lesliei* 'C10', *Lithops lesliei* 'C14', *Lithops salicola* 'C34', *Lithops salicola* v. *maculata* 'C86'.

Sixty years on the horticultural scene, Mary Ann Heacock is one of Colorado's premier plantswomen and the mentor of generations of gardeners.

Penstemons: Naturals for Colorado

Ann and Dick Bartlett

While gardening can only be an emulation of the beautiful Colorado natural environment, we also strive to bring home our memories of the many wild plants we encounter in the mountains, foothills and high plains.

Perhaps our most successful achievement has been growing some of the nearly 250 species of American penstemons. Penstemons, members of the Scrophulariaceae, are noted for their large five-lobed, bell-shaped flowers. Another prominent characteristic is their sterile stamen, which is fuzzy or hairy—hence their common name "beardtongue."

In the wild, most penstemons thrive in arid, gravelly soils in a sunny locations. This makes them ideal for the rock and water-smart gardens that are fast becoming popular in Colorado. Most penstemons are reasonably long-lived perennials if given rapid drainage and limited water. More penstemons have been lost to too much watering than from too little. Our rock garden soil is composed of one-third gravel, one-third sand and one-third garden soil. It is dressed with a salmon-colored scree of Pike's Peak granite.

Penstemons can be easily cultivated from seed or cuttings. The plants produce large quantities of seed in brown prickly capsules. Seed can be sown directly into pots with a soil mixture of play sand, peat and perlite. The pots are then placed in a cold frame for a winter dormancy period to await germination in the spring. If nothing germinates the first year, these pots are best held over for at least another winter.

Gardeners are attracted to penstemons for their variety of intense colors. Most bloom in late spring and early summer, deep crimson, pale violet, shell pink, rich blue-purple, glowing turquoise and, occasionally, yellow. Penstemons come in all sizes, from five feet tall to minute mats one inch high. The latter are ideal for a town house rock garden or in a miniature stone trough. These uniquely North American plants are on the forefront of the latest introductions to the garden and are a break from the usual European floral domination. The following ten penstemons are our favorites for the rock garden.

Blue-mist penstemon Who could resist growing a plant with this name? Ruth Ashton Nelson describes *Penstemon virens* as covering the Colorado foothills along the Palmer Divide in such abundance as to give the slopes a misty blue appearance from afar. From a mat of shiny, green leaves sprout many stems of deep blue blooms that rise up to a foot tall. *P. virens* is long-lived in the garden. It spreads by putting down lateral roots to establish new crowns. It can tolerate full sun, but it is also happy with some shade and a pine needle mulch similar to that found in its natural ponderosa pine environment. In our garden, *P. virens* helps us remember picnics held among vast fields of them along the Front Range.

Penstemon nitidus Imagine a penstemon with bright robin's egg blue bells and thick gray leaves that starts blooming in April. *P. nitidus* is a prairie plant hailing from eastern Wyoming and into Nebraska. This short stature plant thrives in an arid, alkaline soil

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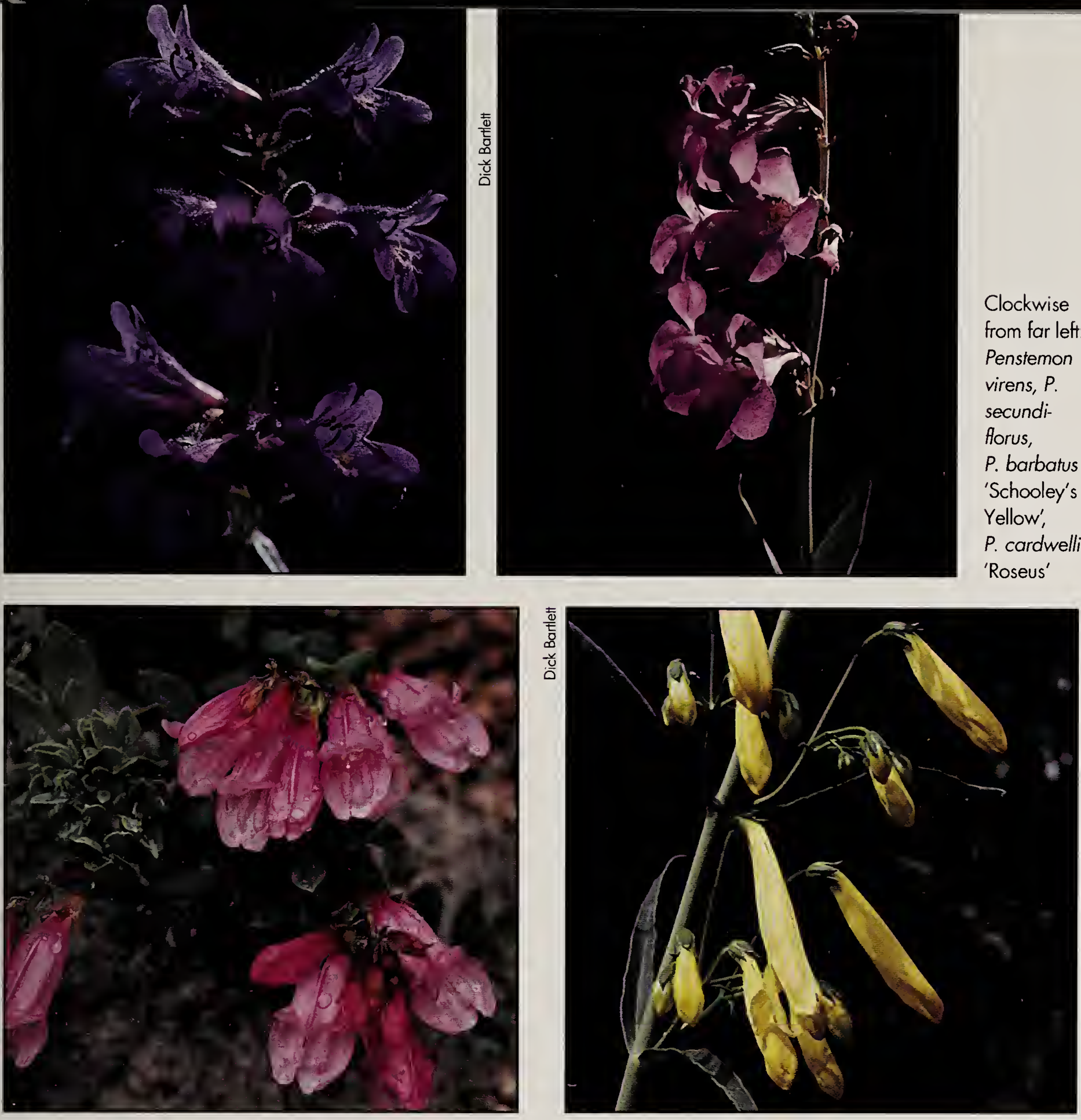
Ann and Dick Bartlett are champions of native plants, natural gardening and, in particular, penstemons. Their Lakewood, Colorado, garden is an exquisite treasure trove of plants.


Dick Bartlett

Dick Bartlett

Dick Bartlett

Dick Bartlett

Clockwise from far left: *Penstemon virens, P. secundiflorus, P. barbatus* 'Schooley's Yellow', *P. cardwellii* 'Roseus'

with good drainage. In fact if the soil around it is too acid it will mute its brilliant color. It has been long-lived in our garden and maintains its bright hue in our poorly nourished gravelly soil.

Shrubby penstemon *Penstemon fruticosus* is one of the most ideal rock garden penstemons with its leathery evergreen foliage and woody stems that drape fetchingly over adjacent stones. Many shrubby penstemons of the Dasanthera section (as *P. fruticosus* is) are native to the northwestern mountains of the United States. It grows about a foot tall and is about 18 inches wide, and it is usually covered with large lavender flowers although there are also white and pink forms. We had marginal success with this plant until we realized it needed more shade and a bit more moisture. A cutting of this beautiful plant came our way at a plant sale and now its legacy continues on in our eastern sloping garden slowly creeping over a rock under our crabapple tree!

Crested penstemon The crested penstemon, *P. eriantherus,* is a hairy native of the high plains and foothills. Its stems and leaves are fuzzy with hairs and even its protruding staminode is bearded with yellow hairs. In spite of this description, *P. eriantherus* is a beautiful plant with large fat flowers ranging in color from pale lavender to pink. Purple nectar guides lure giant bumblebees to its tubular interior for pollen. The bees tumble inside and emerge covered with it. This six- to 10-inch plant prefers the dryland garden and appears to be a short-lived perennial. Cutting back the stems after blooming may increase its longevity, however; it is easily grown from seed. Sometimes a short-lived penstemon becomes a longer-lived one when the perfect microclimate is found. This is part of the intrigue of this genus.

Hall's penstemon Found at about tree line *P. hallii,* an endemic plant of the central Colorado mountains, puts on a spectacular mass of brilliant violet-purple flowers in late June and early July at Boreas pass and on the road to Kite Lake. It has done very well in our Lakewood garden in a lean scree of sand and gravel. Every year when it blooms it reminds us of our favorite outings to these mountain areas.

Pygmy penstemon One of the eastern penstemons, *P. hirsutus* 'Pygmaeus' is a dwarf four- to six-inch beauty and also is a great favorite. Its two-tone lavender and white flowers and dark burgundy foliage are striking. Like most eastern penstemons it prefers dappled shade and abundant moisture. Our pygmy penstemon droops over flat rocks bordering a dry stream bed in the backyard portion of the rock garden. It reseeds well, and it is fun to see where it will take hold next. These new young plants are a joy to dig up and give to friends and visitors, as we feel it is one of the very best rock garden plants.

***Penstemon cardwellii* 'Roseus'** The origins of *P. cardwellii* are found in the moderate elevations of the coastal mountains of Oregon and Washington. This low shrubby penstemon normally produces wine purple to deep blue-violet flowers but a naturally occurring brilliant carmine-rose variant has been discovered and introduced to the nursery trade. Like the other species in the Dasanthera group it prefers some shade, more moisture in our dry climate and a crevice or rocky slope to spread across.

Firecracker penstemon The fire engine red, tubular corolla of *P. eatonii* is shockingly bright and is easily grown. However this plant is a bit too large for a small rock garden and can be confused with the red forms of *P. barbatus* to the uninitiated gardener. Maybe its place is best in the dryland border or in a large boulder field. A two- to three-foot native of southwest Colorado, the firecracker penstemon precedes the Fourth of July in Denver with its bloom in June, but is still lends a lot of snap to the garden! We have not found it difficult to grow except that it got badly frosted one year with a very early cold spell.

Whipple's penstemon This poor, maligned plant has been described as dingy, droopy and shy! Well, for us it is not shy but a frequent and friendly companion during our mountain treks as it is widespread in the Rocky Mountains. Easily found on the road to Mount Evans, *P. whippleanus* produces both a dark purple and a muddy cream-colored form, each about a foot or more tall. A more spectacular wine red variety is found south in the San Juan Mountains. Whipple's penstemon is an easy plant to grow with some afternoon shade and a normal loamy soil at our elevation.

'Schooley's Yellow' penstemon Another favorite penstemon, more suitable for the larger rock garden or water-smart border with an interesting pedigree is a form of *P. barbatus.* Its corolla takes on the shape of an elongated shark's head. And this species has served as the sturdy stock for many of today's hybrid penstemons. One of these, a natural occurring hybrid, 'Schooley's Yellow' is a bright lemon yellow, two to three feet tall. It was found by Gussie Schooley of New Mexico. Dr. Dale Lindgren of the University of Nebraska at North Platte further developed this penstemon for its disease resistance and longevity. Like other *P. barbatus* 'Schooley's Yellow' is a sturdy upright plant which lasts for years. It appears to be one of the brightest of the yellow penstemons and a suitable place should be found for it in every garden.

We hope this exploration of a few of the wonderful penstemons has stimulated your interest in these all-American plants. If so, you may wish to join the 450 other "penstemaniacs" who are in the American Penstemon Society.

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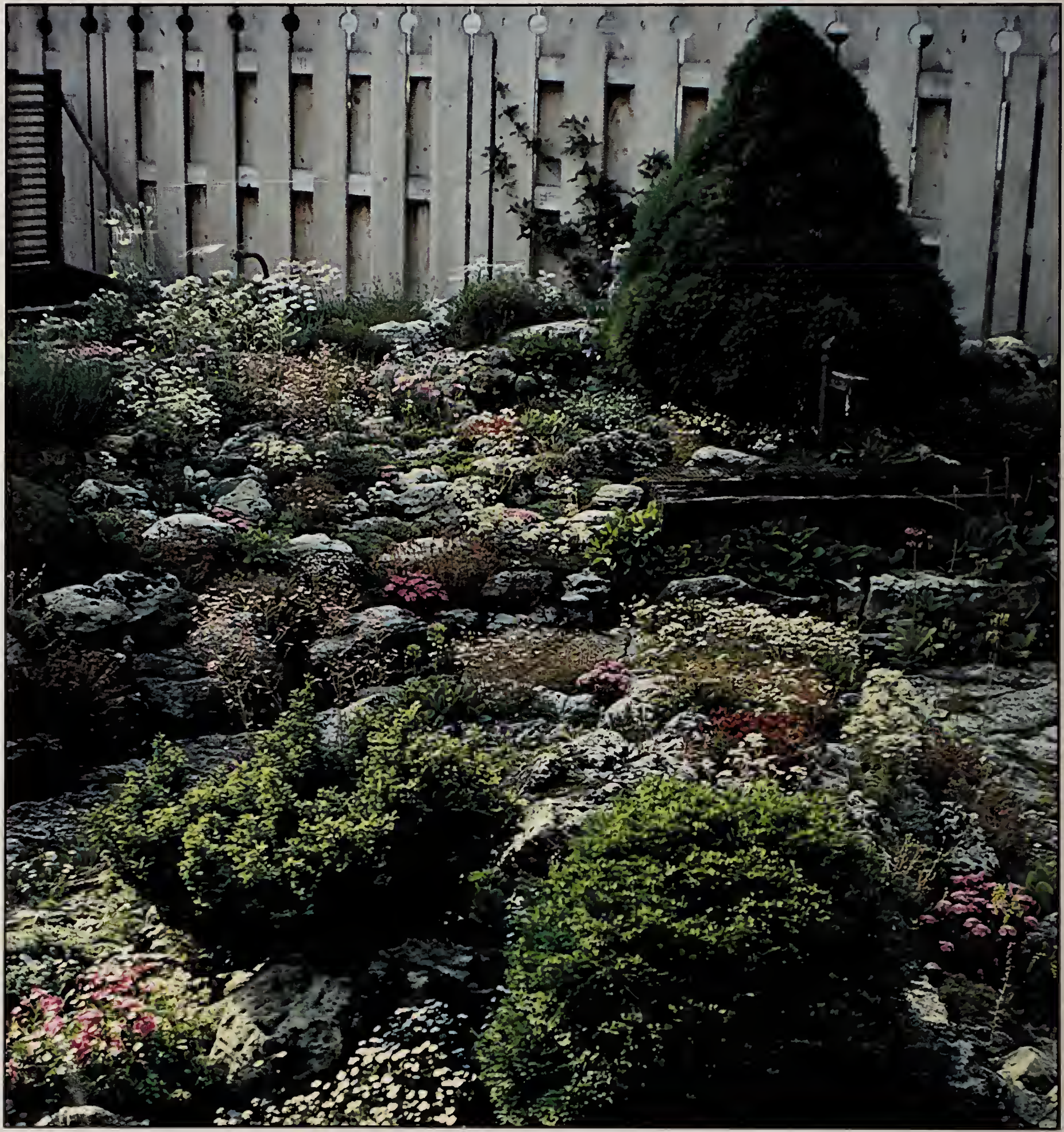

Deciduous Trees

Mountain, Plain and Garden

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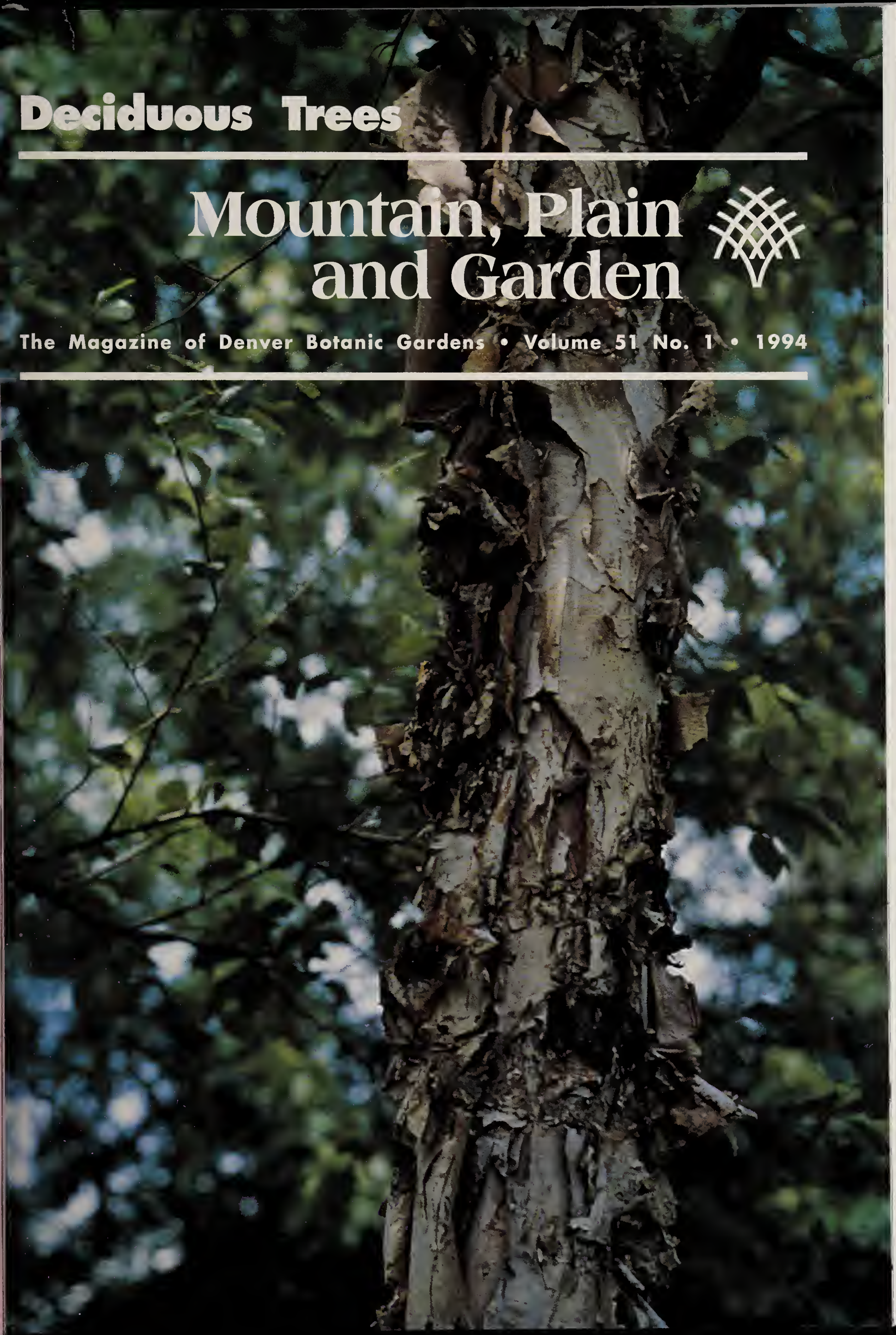

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Trees—a Denver Tradition

Denver, like other towns and cities on the Eastern Slope, has evolved into a "green oasis on the Great American Desert" by virtue of the men and women who migrated here. Early settlers began planting trees even before the completion of Smith's Ditch, Denver's first reliable source of irrigation. Now, 134 years later, our streets and gardens are graced with nearly every species of tree that can possibly grow here.

For the most part, trees were tested and found appropriate, or not, through the adventurous efforts and experimentation of homeowners and gardeners. Local horticulturists and nurserymen contributed to the body of local tree wisdom so the urban forest grew even more diverse.

In 1905 the Colorado State Forestry Association published "The Forests and Exotic Trees of Colorado" in which W.G.M. Stone listed 69 different kinds of trees which were then growing in Denver—all but seven on private grounds! Denver's street tree tradition began when roads were little more than dirt wagon tracks. The very first trees planted were locally gathered cottonwoods. Then box elders and soft (silver) maples were tried. Later, black locusts, ashes and elms expanded the tree palette, as people realized other species would actually survive here.

About 1873, a man named James Richard planted two rows of black walnuts along a lane in Edgewater, and bur oaks were starting to be grown by farsighted pioneers. After that, nurseryman Hiram Wolff was the first to experiment with apple trees on his Clear Creek ranch, where the finest hackberries in the region grew around his home. William Byers, editor and owner of the Rocky Mountain News, introduced dozens of new trees to the area. He grew some 35 varieties on his own property.

According to Mrs. Katharine Bruderlin Crisp, Denver's foremost tree chronicler who wrote her 1933 thesis on trees of the area, other sites for early tree experimentation were the cemeteries and the municipal parks. More than 30 species of trees were planted at Fairmount Cemetery, and 47 varieties of trees grew in Cheesman Park alone. In one park developed on former nursery lands a person could see Japanese pagoda trees, sycamores, horse chestnuts, sycamore maples, tulip trees, black alders and several species of oaks.

The public schools became outdoor laboratories in the next phase. Skinner Junior High became an arboretum of sorts. Byers Junior High, built on the home grounds of William Byers, boasted mulberries, chestnuts, Russian apricots, butternuts, lindens, cutleaf maples, hawthorns, Kentucky coffeetrees, hackberries and more.

A group of pioneer men and women who called themselves the Old Cronies Club landscaped the road from the Denver Museum of Natural History in City Park to the park's lily pond, planting sycamore trees, Kentucky coffeetrees, English oaks and tulip trees—all at their own expense. This road is still called Old Crony Lane.

Finally, the era of Denver's Mayor Robert Speer (1904-1912 and 1916-1918) was the Golden Age of tree planting. Under Speer's direction the talents of city landscape architect Saco Rienk DeBoer were used to best advantage as the "garden system" of parks and tree-canopied boulevards flourished. During the City Beautiful era, the street tree became a symbol of civic

pride in a community-wide effort to dignify every block with trees.

By 1933 Denver was home to 105 different species of trees. DeBoer and a group of like-minded citizens pressed for a "botanic gardens" where additional trees and shrubs could be tested for hardiness in our unique climate. In 1951 that dream became a reality.

Until recently, Denver's legacy of trees had been deteriorating for several decades. Age, neglect, pollution, disease, severe weather and the chain saw all contributed to the decline of the tree plantings along streets and in parks.

However, through a $3 million dollar bond and citizen groups like Denver Urban Forest, The Park People, Volunteers for Outdoor Colorado and numerous neighborhood organizations, with help from Denver's Parks and Recreation Department and the Denver Water Department, attention has been directed toward restoring and maintaining one of the city's finest civic traditions and greatest assets—our trees.

Top: Mayor Robert Speer personally supervised the distribution of free saplings to Denver homeowners at annual Arbor Day observances.

Above: Early Denverites often took elaborate measures to protect their newly planted trees, scarce and valuable additions to the prairie landscape.

Reading Our Landscape of Trees

Diane Ipsen

In the 1990s, citizens of towns and cities on the Colorado Plains take for granted their lovely, sheltering canopies of "urban forests." However, in this locale a century and a half ago, the poetry of the land was not written in trees, but in prairie grasslands and creekbottoms and occasional scrub. Trees, mostly coniferous, grew only in the foothills and higher. Cottonwoods or willows were scattered along the watercourses, but for the most part, trees had no place in a plains ecosystem.

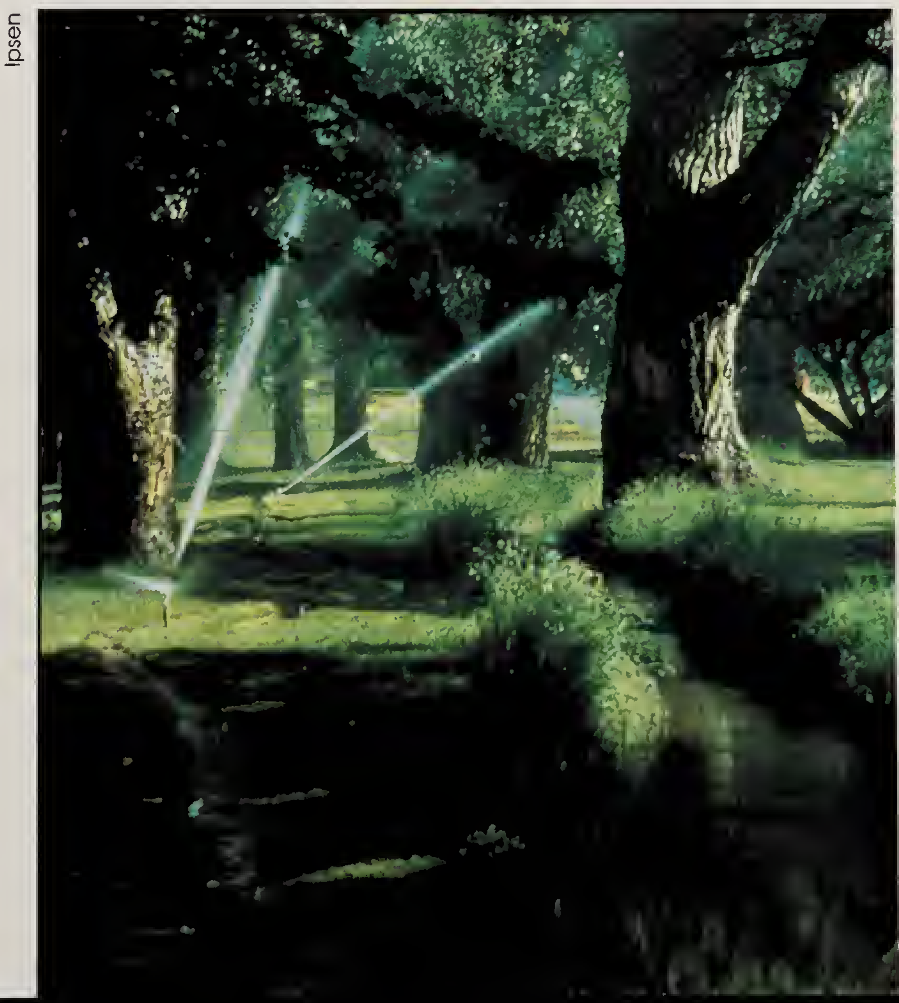
On the Great American Desert the appearance of trees announced the pioneers' arrival. Far from signifying wilderness, trees on the Great Plains symbolized settlement, human activity and the interaction of European peoples with the land. Connections between trees and the human psyche have always run deep, but this natural reverence may be intensified in arid, untimbered country.

The planting of trees and the systems of irrigation ditches needed to nurture them were the earliest and most visible signs that people from the East had come to conquer and impose order on the land. Even now, we recognize and perpetuate the simple pattern of the homestead encircled with sheltering trees, and it speaks of place-making, protection and settlement. Today on the plains, long after dwellings have crumbled or burned down, one is able to sense the domestication of places where pioneers had settled. Groves of trees and other woody vegetation mark the spot.

In this sense the landscape as modified by humans is a vast historical record offering clues to the past. And trees, enduring and visible, are testimony to past intents and actions on the land. However, the domesticated landscape is ultimately mutable, and many features long since erased are known to us only through legends, photographs, maps and names.

For example, persisting "tree" place names offer clues to local landscape history. Baggage tags labelled ORD on items destined for Chicago's O'Hare Airport are simply expressive of the place name "Old Orchard," which has been given to the region of fruit orchards that formerly covered the airport site.

The old and the new: A sprinkler system now waters the banks of City Ditch in Washington Park. Irrigation has always been necessary for growing trees in Denver.



Ipsen

Landscape architect Diane Ipsen, consulting editor of *Deciduous Trees,* is a long-time contributor to DBG. Her professional practice, DDI Design, specializes in residential landscapes.

A line of cottonwoods reveals the course of an old agricultural ditch that still traverses Loretto Heights Park.

Likewise, the local name "Hackberry Hill," given to a high bluff north of Arvada, signifies some of its intriguing history, as revealed in the "Legend of the Hackberry Tree": Once, this otherwise barren hill was home to a mysterious lone hackberry tree, conspicuous from a distance and a landmark on the treeless plains. Old photographs show a short, twisted tree with a kink in its trunk. It was thought to be extremely old, having grown very slowly.

The 1843 Fremont Expedition is said to have noted the tree standing on its lofty site, but no written record of such has ever been found. It was a puzzle how a non-native tree came to be growing in such a dry hostile place, long before the arrival of the first Eastern settlers. But one theory supposed that it sprouted from the grave of an Indian chief, slain in battle and buried on the hill. Perhaps he had been buried with his favorite amulets to ward off evil, which might have included a pouch of souvenir hackberry seeds gathered on some distant hunting expedition.

Another folk tale tells of a Sioux medicine man who planted hackberries on high ground across the West, as never-to-be-disturbed altars to the Great Spirit.

Non-romantics among us may prefer the supposition that the seed was brought to Hackberry Hill by migrating birds from the Missouri River Valley.

At any rate, government surveyors planning a new road over Hackberry Hill in 1936 met with citizen outrage when they decided the aged hackberry would have to be cut down. Even the State Historical Society became involved in the battle, so officials agreed to transplant the tree. On the eve of its journey, with a big trench dug around the roots, the tree was cut down by an unknown vandal. According to one source, in 1974 someone did confess to the heinous deed, silencing those who suspected the Great Indian Father had sought revenge on the white man for building a road on sacred ground!.

The state lost its only native hackberry, but place names such as Hackberry Hill Elementary School and Hackberry Hill Amoco preserve a bit of local history.

Similarly, the name of Alamo Placita Park along Speer Boulevard on the north bank of Cherry Creek means "Little Place of the Cottonwoods" and recalls the original tree cover in that location. A beautiful stand of old cottonwoods growing in this creek-bottom area had become a favorite picnic spot and something of a sacred grove for early Denverites. Original park plans, as well as the name, preserved the trees.

Those lost tree landmarks are now known only through photos, place names and legends. But other trees from the early days of Denver still survive as evidence, telling us of human activity long ago.

An observant person sometimes will notice a line of ancient cottonwoods cutting across a neighborhood, marching through backyards, or traversing an office complex, golf course or park. From a distance, especially, this pattern of giant trees stands out, marking the route of a 19th-century irrigation ditch—forming a lineal forest strangely at odds with contemporary land patterns imposed around it. Painstakingly carved out on the arid plains from the 1860s to the 1880s, irrigation ditches coursed through land that was initially rural in character.

Today this network of ditches still crisscrosses Front Range cities and suburbs. But as neighborhoods and subdivisions have grown up around them, these little tree-lined acequias have disappeared, hidden in alleyways, backyards and underbrush, even shunted into pipe. Only their cottonwood companions reveal their routes. In their new contexts these giant ditch trees seem awkward, struggling to fit in with plots of house and bluegrass and exotic vegetation—but this is also their charm.

By their presence we sense the persistent traditions of frontier Colorado poking through the urban fabric and we're reminded of where we live and of the labors of our predecessors. Modern horticulturists may think of cottonwoods as cheap trees, but once people toiled mightily to have and preserve them.

Like the ditch cottonwoods, other ancient trees are historical indicators in the landscape. Motorists on South Federal Boulevard in the vicinity of Union, Tufts and Stanford avenues may notice the arresting, inordinately large bur oak trees growing along the west side. These are the historic Sarah Brown Oaks, demarcating what was once Sam and Sarah Brown's farm on this site near the South Platte River. The oaks are awesome in size, reminiscent of Midwestern trees. In fact, they look out of place, dominating yards in a subdivision of modest one-story brick houses.

In 1870 Sarah Brown had carried home acorns from a visit to Missouri and Kansas, and she planted them along the road and boundaries of the farm. This was a common marking practice of the day. Long after these homesteaders were gone, their trees endured as a living historical reminder.

In 1934 our State Forestry Association reported that 26 of the magnificent trees were standing. A recent expedition noted only six or eight burr oaks on the west side with several more across Federal toward the river, seemingly from the same planting. As one admires these magnificent specimens, sensing their indignity at the doghouses and encroaching chainlink at their feet, one can only lament that this land was not preserved as a park to celebrate their legacy.

Another indicator in our local landscape is the mature planting of Koster blue spruce and tall pines along Speer Boulevard on the south side of Cherry Creek between Logan and Clarkson streets. These trees are the most visible remnant of Mayor Robert Speer's and S. R. DeBoer's elaborate 80-foot wide "forest belt," specifically the "evergreen extension," installed along Cherry Creek in 1917 and 1918, partly to screen an unsightly dump from motorists' view.

Speer had been inspired by "city forests" while visiting Germany and was eager to create one in Denver. This portion of the road was named Forest Drive, and it became one of the "sights of the city" according to DeBoer. Though most of the forest belt is gone, even today one is struck by the abrupt change from deciduous to evergreen trees east of Logan.

Have you ever noticed two double rows of European lindens gracing the northwest edge of Cheesman Park? It seems a rather rigid and linear arrangement for a park designed in the tradition of Frederick Law Olmsted. But in fact the trees are clues to a vanished landscape: At one time Franklin Street cut through the western edge of the park and the lindens were planted along both sides, in accordance with Reinhard Schuetze's 1902 plan. German-born Schuetze, the city's first landscape architect, designed Franklin Street to be Denver's version of Unter den Linden, the famous strasse in Berlin which had so impressed Mayor Speer. While the street was removed in the '20s to ease traffic and eliminate "drag racing" in the park, the surviving trees still indicate the old route.

As long as the planting of trees remains a primary endeavor of human beings, trees will provide a visible record of people's activity and intervention, especially in the West. Land uses may change, but the purposeful assembling of trees in the landscape can endure for generations. If we know what to look for, we can extract fascinating insight about the past by "reading the landscape."

Ipsen

Above, left and right: The magnificent Sarah Brown Oaks, planted to mark the boundary of a 19th-century homestead, persist with an urban landscape at their feet.

Right: Polypropylene mulch has been useful in reducing the water needed to establish windbreak trees at Chatfield Arboretum.

Below: The arboretum serves to meet the challenge of developing new trees for the High Plains.

Practical Plains Forestry

Chris Hartung

Recent visitors to Denver Botanic Gardens' Chatfield Arboretum have noticed a gradual change among the seeded prairie grasses that dominate the arboretum's flat expanses: Thousands of tree seedlings now poke their tops above the 4-foot high grasses.

As programs and gardens grow at the arboretum, perhaps the least noticed but most significant things to emerge are these trees. They are an integral part of the first stage in developing an arboretum on Colorado's open High Plains. Their job is to provide a favorable climate for future plants: to provide protection from the drying winds and to harvest snow moisture.

Many visitors recognize these tree zones as windbreaks or shelter belts: trees and shrubs planted in several adjacent rows. They influence the climate in specific ways, depending on their design.

Why should we even try to plant trees on the High Plains? Very simply, they make our communities, farms and ranches more resource efficient.

Substantial research shows that we benefit economically if trees are well-placed throughout our agricultural and urban settlements. In fact, windbreaks are still considered the best defense against soil erosion during periods of drought, when other types of vegetation will not persist. Contrary to the belief that they require additional watering, some types of windbreak trees can be grown in Colorado without it. In addition, a diversified windbreak provides food and shelter for wildlife.

The history behind windbreaks on our Great Plains reveals their value. The need for trees on the prairie was demonstrated during the Dust Bowl Era, when the sky was blackened with soil blowing off cultivated lands across the plains from North Dakota to Texas. One result was the Prairie States Forestry Project from 1934 to 1942, when 222 million trees were planted in windbreaks and shelter belts. This was the largest tree planting ever undertaken in the United States. The first shelter belt of the project was a 1935 planting in Oklahoma of Austrian pines; it is still providing protection to that land today and is a living monument to man's perseverance on the prairie.

While some new windbreaks are still being planted, over the past 15 years many agricultural enterprises have been cutting down windbreaks to make room for more crops or accommodate center-pivot irrigation systems. Combined with natural attrition, this has resulted in a dramatic decline in numbers of windbreaks throughout the Great Plains. It is a cause of concern.

Recently, the New Farm Bill created incentives to agricultural enterprises to plant more windbreaks. A program called "The Center for Semi-Arid Agroforestry" at the University of Nebraska-Lincoln is coordinating with federal and state agencies to conduct research and to combat the decline in windbreaks by initiating another massive planting effort comparable to the 1930s.

Chatfield Arboretum is recognized as a collaborator and leader in windbreak technology. It offers some of the best examples of wind-

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Chris Hartung, a Denver Botanic Gardens horticulturist for seven years, is Chatfield Arboretum's supervisor. His interests are in drought-resistant woody plants and prairie ecosystems.

breaks in the state. Many of the more than 50 species of trees used in our windbreaks are not traditional windbreak species nor have ever been cultivated in Colorado before.

Since our primary objective in planting windbreaks at the arboretum is practical, I have tried to anticipate which species are likely to thrive, and to plant more of those species. Both failures and successes, though, will be important information for plains forestry and dryland horticulture in Colorado.

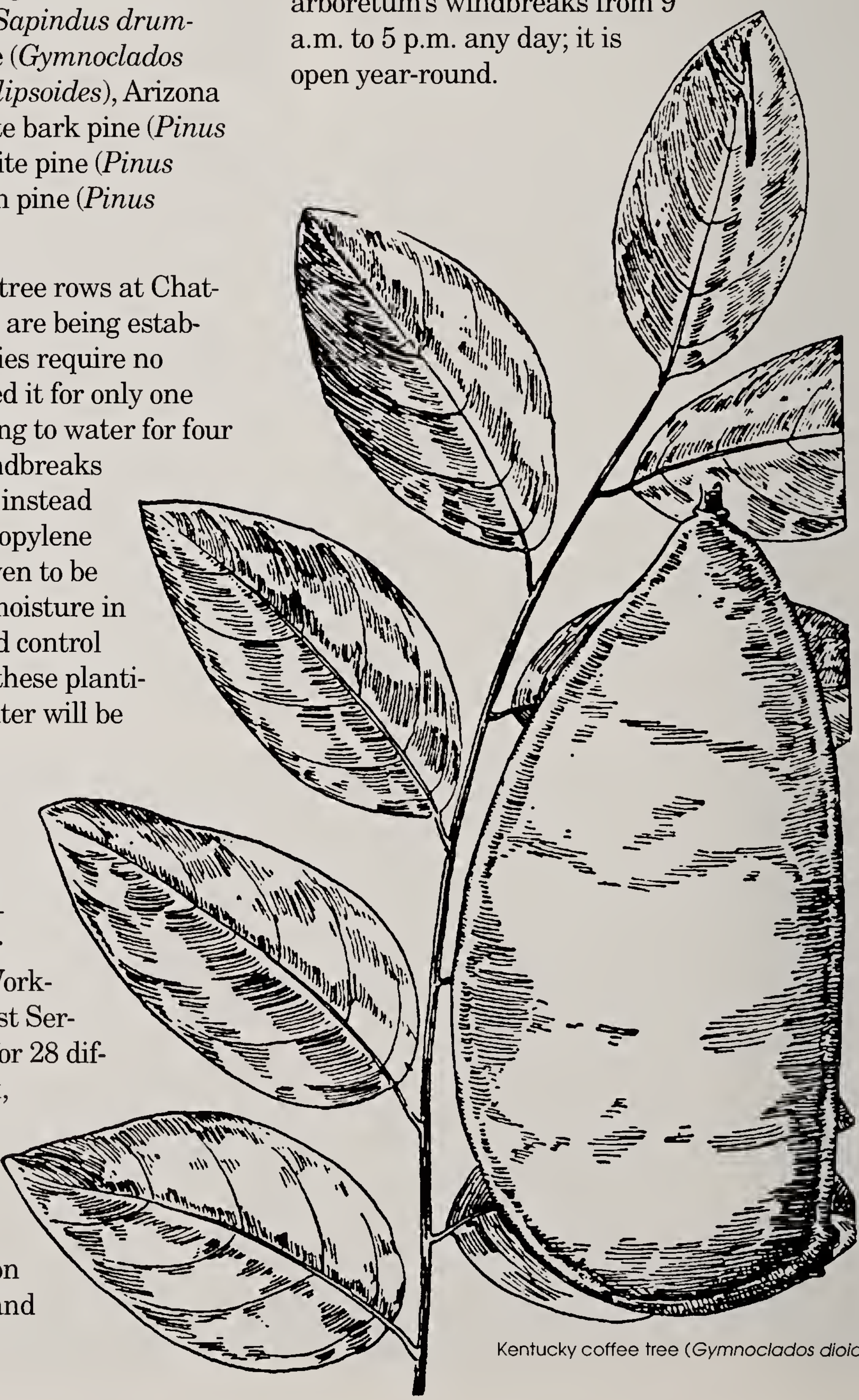
A few examples of seldom used and uncommon tree species being grown at Chatfield are western soapberry (*Sapindus drummondii*), Kentucky coffee tree (*Gymnoclados dioicus*), jack oak (*Quercus ellipsoides*), Arizona walnut (*Juglans major*), white bark pine (*Pinus albicaulis*), southwestern white pine (*Pinus strobiformis*) and Macedonian pine (*Pinus peuce*).

Most of our 16 miles of tree rows at Chatfield Arboretum have been or are being established with water. Some species require no water to establish, others need it for only one year, and some we are choosing to water for four or five years. Some of our windbreaks do not receive any water, but instead are established with a polypropylene material mulch that has proven to be effective in keeping natural moisture in the soil. Eventually only weed control will be necessary to manage these plantings, and no supplemental water will be used.

This year three new windbreaks (500 trees) were installed as part of a 20-year, multi-agency, North America-wide provenance study of bur oak (*Quercus macrocarpa*). Working with Colorado State Forest Service, we are providing a site for 28 different seed sources of the oak, which will tell researchers which seed sources, geographically, are best suited for Colorado. Other source studies are being conducted on Scots pine (*Pinus sylvestris*) and western soapberry.

The need to develop and discover additional trees that can adapt to our environment is one of the most important challenges for horticultural researchers in Colorado and on the High Plains. Long-term tree research is usually not a high priority for many agencies and universities. This is why it is important for everyone—citizens, agencies, industry—to cooperate in making such research possible. And it emphasizes the need for an institution like Denver Botanic Gardens' Chatfield Arboretum where cooperative efforts can be realized.

Visitors can observe the arboretum's windbreaks from 9 a.m. to 5 p.m. any day; it is open year-round.



Kentucky coffee tree (*Gymnocladus dioicus*)

Barking up the Right Tree

Diane Ipsen and Alan Rollinger

The sorts of trees being planted in our Front Range landscape are determined by many different people. Homeowners, designers, landscape architects, urban foresters, park planners, developers, nurserymen—all contribute to the tree cover of our locale.

With such a diverse bunch selecting the trees, the monotony and predictability of what gets put in the ground is inexplicable. Generally, we are in a crabapple-and-aspen rut, with a few thousand honeylocusts, green ashes, suckering Shubert chokecherries and narrowleaf cottonwoods thrown in for the maintenance people. If screaming boredom isn't enough of a reason to try something different, the fact that these four or five overworked trees have some serious drawbacks ought to be.

For example, few trees planted on the Colorado plains are more plagued with diseases than the short-lived aspens. Their habit of suckering, while not as destructive as that of narrowleaf cottonwoods or chokecherries, is guaranteed. And at lower elevations they don't often display the coveted autumn gold. Crabapples need almost constant pruning to remove the vigorous suckerwood, and all too often end up chopped into ugly stumpiness at the hands of misguided tree trimmers. Also, fire blight is a problem on many varieties (see "Crabapple Update") and rotting apples are a squishy nuisance when they fall on patios, tennis courts, drives or sidewalks. Neither aspens nor crabapples do well in shade.

Green ashes and honeylocusts have simply been used *ad nauseum.*

Nevertheless, all these trees continue to be specified repeatedly and planted by the truckload. Are we suffering from arboreal anemia? Transfusions, please!

Infusing some new blood into our pool of possible choices does not have to be risky business. Happily, there are any number of reliable trees that qualify as excellent alternative selections for our region—trees which are beautiful, interesting, versatile, durable plants. They just need more "press."

To that end we submit to the enterprising gardener and designer the following short survey of trees which we feel deserve greater attention and use, and which are in many ways superior to those more commonly chosen.

Rollinger

Purple leaf European beech

European Beech

A mature specimen of purple-leaf European beech (*Fagus sylvatica purpurea*) is a sight to behold. The rich purple-bronze foliage, smooth gray bark and unusual branching structure are an unsurpassed combination. With maturity,

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Landscape architect and Colorado State University graduate Alan Rollinger specializes in residential planning. A pioneer in water-saving landscape design, he has more than 800 projects to his credit.

the bark develops an elephant-hide appearance which is quite beautiful and unforgettable. Not the least of its attributes is its stateliness for it often grows more than 50 feet in height and tends to branch close to the ground, with a nice, broadly-oval form. The lustrous leaves turn a rich russet and bronze color in fall.

While European beeches are rare in this area, they do grow here—and there are a number of grand old specimens around Denver. The southeast corner of St. John's Episcopal Cathedral at 13th Avenue and Clarkson Street in Denver is virtually screened by the dense purplish foliage of an enormous European beech planted decades ago. Between Marion and Lafayette streets along Third Avenue grows another magnificent specimen. All the beeches in our area are the so-called purple-leaf beeches, selections from the standard green-leafed tree. Just which selections they are no one can tell. There are numerous purple beech cultivars; leaves of a common one in the nursery trade, 'Riversii', emerge a deep purple and remain a purple-green into summer.

Beech trees have always been important to humans. Beech nuts are still eaten in some parts of Central Europe, as they were by Stone Age people. In the Old World, the abundant beeches provided heating fuel and charcoal for the iron smelters. Beech was considered the general utility hardwood of Europe for every timber need, from furniture to tool handles to wooden shoes!

While beeches are relatively tolerant of various soil conditions, along the Front Range they need a well-drained location. If at all possible, you should try a beech, for its attributes make it one of the finest trees in any landscape. Perhaps there is none finer.

Asian Whitespire Birch

Birch (*Betula*) is a beautiful and diverse genus, but one which has not been without its problems. The scourge of the birch world is the bronze birch borer, a small opportunistic beetle that tunnels beneath the bark of trees under stress. By the time injury has made itself evident, it is usually too late to save the tree.

Ipsen

Asian Whitespire birch

Consequently, the white-bark birch industry almost died at one time. But due to its remarkable resistance to bronze birch borer, and the purity of its white bark, the Asian Whitespire birch has taken the lead for landscape use. It is, however, only moderately resistant to the less-serious but annoying leaf miner.

This tree has an interesting and fairly recent landscape history. All plants of *Betula platyphylla japonica* 'Whitespire' growing in the United States originated high in an alpine meadow in Honshu, Japan. In 1956 John Creech, of the National Arboretum, passed through this meadow in search of a certain rhododendron and was attracted to a beautiful specimen of birch with gleaming white bark. He brought seed back to the United States. The resulting trees reside at the Brooklyn Botanic Gardens and Longenecker Horticultural Gardens at the University of Wisconsin where in 1983 the name 'Whitespire' was made official. Later, in controlled testing to determine borer resistance of various birches, Whitespire clearly outperformed other species.

Whitespire birch is a pyramidal tree reaching 40 to 50 feet in height. It is loveliest grown as a clump and displays its chalky-white nonexfoliating bark at an early age. Cultural requirements are the same as for *Betula nigra*. Reported to be tolerant of heat, this tree will do best in moist but not wet soil. A periodic winter watering is important. Two young Asian Whitespires are planted at the entrance to Wellshire Inn.

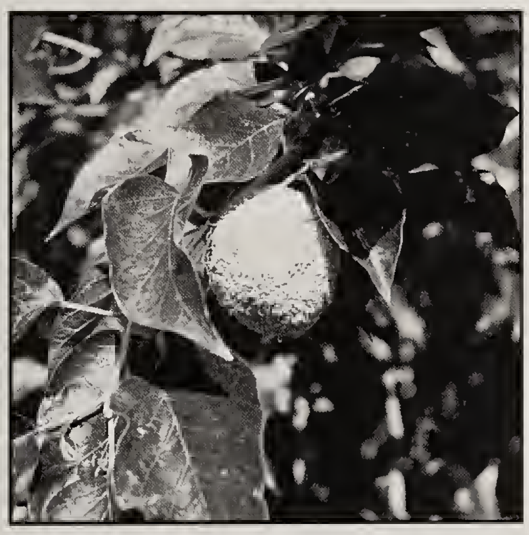
Eastern River Birch (Water Birch, Black Birch)

The eastern river birch (*Betula nigra*), not to be confused with the Colorado river birch

(*Betula fontinalis*), is a native American tree found on streambanks and in swampy forest lowlands.

This beautiful, fast-growing tree is notable for its distinctive shaggy bark mottled with tones of cinnamon, salmon pink and cream. Young limbs have a rusty metallic sheen, which on mature limbs exfoliates in appealing papery tatters, giving the tree a wonderful winter value in the landscape. The leaves are larger than some birches: up to three inches long, thick, deep green and lustrous above. Fall color is yellow.

Eastern river birches are reported to have great resistance to heat and cold. Most sources state that they prefer acid soil but are adaptable, and observations around Denver would bear out their ability to adjust to our alkaline soils. While supposedly tolerating wet places, they require well-drained soil and need even, consistent moisture. As with all birches grown in this area, these require winter watering during dry spells. (When you see a truly healthy, good-looking birch here, you can be certain it has remained that way through wise management: i.e., late fall and winter watering after automatic sprinkler systems have been turned off.)


Ipsen

Osage orange fruit

Eastern river birches are graceful in form, being particularly handsome when grown in clumps or planted in groups. Stalwart resistance to the serious pest bronze birch borer has given eastern river birches new status as ornamental landscape trees. They are big birches, ultimately growing to 50 or 60 feet.

Birches should be planted with the root ball 2 to 4 inches above the surrounding soil level. Underplant them with a sweep of groundcover and they will look their best. Diane added three multi-stem clumps of the faster-growing variety 'Heritage' to her garden several years ago and is impressed by the woodsy quality they have created, as well as by their performance. As lovely as the foliage of *Betula nigra* is, the visual treat is in the winter, when the dramatic bark is set against the snow. This is a perfect tree to place where it will be viewed from a window.

Osage Orange (Bodark, Bois-d'arc, Bow Wood)

Almost a horticultural institution in the United States, Osage oranges (*Maclura pomifera*) are found growing throughout most of the country. Nevertheless, many Coloradans have overlooked these small, thorny members of the mulberry family, although the trees are known for their toughness.

Their most attractive feature is their shiny, deep-green foliage which contrasts noticeably with other landscape plants. Their crowns are rounded, sometimes irregular, on short trunks. Flowers are not showy, but they are followed by interesting softball sized fruits with a bumpy rind vaguely resembling an orange. (As kids we would have called them "ammunition trees.") The mess from these bitter yellow fruits is a drawback for landscape use, but with the introduction of the variety 'Park', we now have a fruitless Osage orange tree.

The native habitat for Osage oranges is the rich bottomland of the Arkansas and Red rivers in the region inhabited by the Osage Indians. There the trees' suitability for windbreaks and hedges earned them the name "hedge apples," and many a pioneer surrounded farm land with this "living fence."

Because the flexible wood is strong and hard, it was used to make the hubs and rims of wagon wheels in the horse and buggy days. Few woods are rot resistant when in contact with the soil, but this attribute of Osage orange is the reason the tree was extensively used for fenceposts, railroad ties and cabin underpinnings. One of the numerous uses the Osage Indians made of the wood was for bows and arrows, hence the French name *bois d'arc*, "bow wood." The vernacular name bodark is simply an anglicized version of *bois d'arc*.

Under the 1934-1942 Prairie States Forestry Project, 18,000 miles of shelterbelts were established to protect farms and ranches on the Great Plains—the largest tree-planting effort in our nation's history. Osage oranges were utilized extensively, for they are hardy, adaptable, drought resistant trees. In fact, the poorer the site the better these trees like it.

However, they have not been widely accepted as ornamentals. Now, with the availability of the fruitless 'Park' variety, Osage oranges could help ease the dearth of small trees suitable for landscape work. There is also a thornless Osage orange, the variety *inermis*.

In Denver, a beautiful example of the fruiting species can be seen in a yard near the northwest corner of south Jackson Street and Arizona Avenue. There are also some growing north of Denver Botanic Gardens' main parking lot.

Chinese Catalpa

Probably the best of the catalpas are the trees known as Chinese catalpas (*Catalpa ovata*). Their large leaves have a purple venation which gives them an unusual and attractive purplish-green color. The pretty flowers in late June and July are yellowish-white, striped with orange inside and spotted dark violet.

Even young children are acquainted with the long and stringy catalpa "beans," which add interest to the landscape but which can be a nuisance in the garden. Fruits of Chinese catalpas are narrow, clustered, and more finely textured than those of western catalpas, and therefore less bothersome.

Chinese catalpas grow to 30 feet tall or so, roughly half the size of their more common western cousins. No pests or diseases attack them, although hailstorms can considerably tatter their big leaves.

Chinese catalpas are often best-used as specimens because of their eye-catching texture and flowers. As with several other trees mentioned here, clump forms are particularly appealing. Although not widely known, Chinese catalpas are not new to the Denver area; mature examples can be seen at the entrance to the Denver Zoo, and here and there in the city's neighborhoods.

Rollinger

Turkish filbert

Turkish Filbert (Turkish Hazelnut)

Turkish filberts (*Corylus corluna*) are big handsome trees suited for use as shade or street trees but little known or grown. Their form is symmetrical and pyramidal, and their good-looking, dark green foliage and striking, corky bark make an impressive contribution to the landscape. They are cold-hardy trees that should be planted more often.

Turkish filberts are also reported to tolerate a certain amount of drought and heat, once established, and may be a good choice for a site with little moisture. They will not scorch in city conditions where maples often do. When the eastern United States was experiencing severe drought in recent years, other trees defoliated while the Turkish filberts remained green and vigorous. They are pest free and they adapt to various levels of soil alkalinity. If obtainable, a multi-stemmed specimen is striking.

Actually, Turkish filberts have been in the area for a number of years. Alan specified this tree 20 years ago in his design for the Foothills Art Center in Golden. It has done very well, as have other known specimens in the area. At Denver Botanic Gardens, Turkish filberts can be seen at the south end of the main perennial path.

Swamp White Oak

In their native American range, swamp white oaks (*Quercus bicolor*) are found on the borders of streams and swamps and in low, poorly-drained meadows. They have attractive foliage: characteristic leathery "white oak" leaves with rounded lobes. The species name "bicolor" refers to the two colors of the leaves: dark green above and whitish and velvety below.

Swamp white oaks are long-lived, and throughout the United States many centuries-old trees have become beloved landmarks. Their wood is used to make wine and whiskey kegs, among other things.

Swamp white oaks were planted in the Denver area 50 or 60 years ago and then, for some reason, dropped out of the nursery trade. Several specimens in older neighborhoods have achieved a measure of grandeur over time, one of the most beautiful being on the old Mary Chase estate along Circle Drive in Denver.

About 20 years ago interest in this species was revived, on the theory that a tree which naturally grows in wet, low-oxygen soils should do well in our heavy, clay soils. This has proved to be a good assumption—*if the tree is not overwatered.* Swamp white oaks could be trees that thrive on neglect.

For many years now Alan has enjoyed watching the progress of his favorite swamp white oak, a vigorous specimen that grows in the bentonite clay soil of Broomfield at the home of a relative, a neglectful "erstwhile gardener" who *under* waters. Interestingly, the key to success seems to be deep but infrequent waterings, which ensure that proper oxygen levels are maintained in the soil. In fact, swamp white oaks can be considered xeriscape plants if properly grown.

American Hornbeam (Blue Beech, Water Beech, Ironwood, Musclewood)

American hornbeams (*Carpinus caroliana*) are small, handsome, bushy trees. They should be in greater demand in our region and deserve serious consideration for our landscapes. They are understory trees in the forests, seldom over 40 feet tall, more often reaching only 20 feet. Their slender trunks are short and somewhat crooked, often forking low.

Hornbeams are most recognizable by their distinctive fluted trunks and branches called "musclewood." The spiraled and twisted ripples, to many, resemble a flexed muscular arm. The bark is gray and smooth and appears to be swelling inside itself. This trait is seen even in young trees.

Among the many fine features of American hornbeams are their extreme shade tolerance and absence of mess. There is no juicy fruit, so they make excellent patio trees. Slim catkins appear in spring in conjunction with the emerging leaves, which are polished, thin and translucent. The rather dense foliage turns scarlet and orange in autumn. A "grove" planting of American hornbeams at the Ruth Porter Waring Denver Botanic Gardens House at 909 York Street illustrates their suitability for naturalizing, and the trees may be at their best grown in groups.

Wafer Ash (Hop Tree)

Wafer ashes (*Ptelea trifoliata*) are small patio-type trees that many local tree connoiseurs have admired for some time. They continue to be difficult to obtain but it is hoped that—as with all these trees—increased interest and demand will result in supply! This tree is one of those "sleepers" that demands wider use; it is a better tree than many that are more commonly sold.

Wafer ashes are round-headed trees reaching up to 25 feet tall that perform equally well in heavy shade or sun. Illustrating how deceptive common names can be, they are not true ashes (*Fraxinus*) at all. The plants are native to the East and Midwest but have demonstrated hardiness and drought tolerance here in Colorado. Local specimens have been around long enough to have survived several legendary winters and they have exhibited no problems. Sources list them as USDA Zone 3 plants.

Wafer ashes, of course, also can be grown with irrigation, and they enhance a garden with fragrance and beautiful foliage. Corymbs of small yellowish flowers open in June, releasing a scent surpassing that of any other hardy tree, equaling the most fragrant honeysuckle. The leaves are composed of three dark green, glossy leaflets that turn yellow-green to yellow in fall. Their seeds, which have been used as a substitute for hops, are born in samaras similar to elms. Mature trees exhibit attractive reddish-brown bark. An example of this tree can be found on Marion Parkway just north of Alameda.

These are but a few of the numerous trees that deserve more attention in Colorado. All can be planted with confidence. They will contribute to the diversity of our urban forest and give unique character to personal gardens.

Street Trees

Ken Slump

Individuals and civic groups have worked diligently in recent years to promote tree planting throughout metropolitan Denver's neighborhoods. Their goal is to replace the thousands of trees that have been lost in Denver since the 1960s due to a variety of factors such as Dutch elm disease, street widening projects and old age.

Trees in cities experience a number of stresses not found in their natural habitats. Often they are planted in restricted areas with limited soil surface for water absorption and root development. Soil temperatures are usually higher in urban sites than in the trees' natural settings. Injuries from machines, from lawnmowers to trucks, tear and injure their trunks. Urban air pollution, or course, takes its toll, and street trees in cold climates frequently suffer the additional insult of road salt splashed onto their root zones.

Although numerous species survive here, it is important to note that most never attain the size or the lifespans that they might in their native habitats. Native trees consisted mostly of a few cottonwoods and willows growing along the rivers and creeks.

Denver's mayor Robert Speer was a great promoter of planting street trees in the earlier part of this century. His administration distributed hundreds of trees: stately American elms (*Ulmus americana*) the fast growing soft maple (*Acer saccharinum*) and the thirsty cottonwood (*Populus deltoides*). Many of the elms have succumbed to Dutch elm disease, and most of the cottonwoods, being comparatively short-lived, have died from old age. A large number of the soft maple trees are still living in some of Denver's older neighborhoods; however, many are in a state of decline. Current guidelines in the City and County of Denver prohibit the planting of poplars, aspens and cottonwoods (all of which are *Populas* species) or willows (*Salix* spp), boxelders (*Acer negundo*) and soft maples in the public rights-of-way.

New plantings of the thornless honeylocust (*Gleditsia triacanthos inermis* cvs), green ash (*Fraxinus pennsylvanica lanceolata* cvs) and soft maple have dominated urban planting for the past 30 years. Although these species may merit some popularity, it is imperative that we diversify our urban forests to avoid the Dutch elm disease tragedy which left urban streets across the country planted as monocultures nearly treeless.

What makes a good street tree? Most people favor a fast-growing, disease free, single-trunk tree with ornamental features, with a minimum of maintenance and unnecessary mess or litter. Also desirable in Colorado are trees that do not leaf out too early in the spring or hold their leaves too late into the fall as such trees are prone to breakage in unseasonal snow storms typical of our climate. Drought tolerance, too, is important for Colorado trees, although conclusive data on this characteristic for each species is not complete.

Of all these, rapid growth seems to be the main criterium in our "instant" society. We have been conditioned to wait for nothing. Belying this, many established communities, public gardens and arboreta across the country have plantings or specimens of mature, unusual

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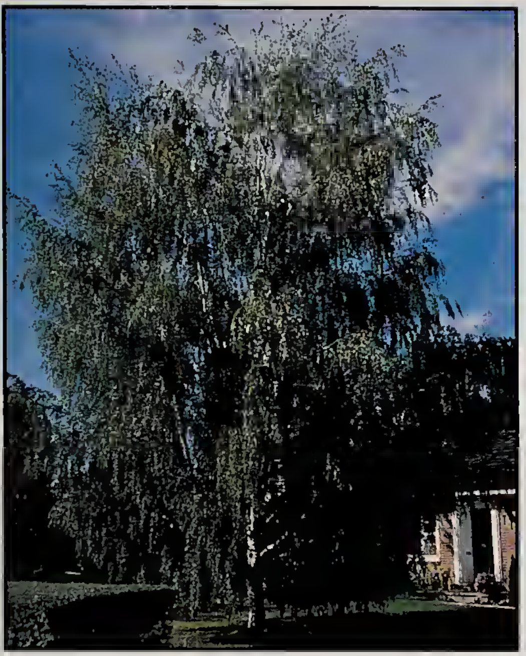
Ken Slump, plant record keeper of Denver Botanic Gardens, is a graduate of Colorado State University, a former arboreal inspector in the Denver Department of Parks and Recreation and a dedicated horticulturist.

Ipsen



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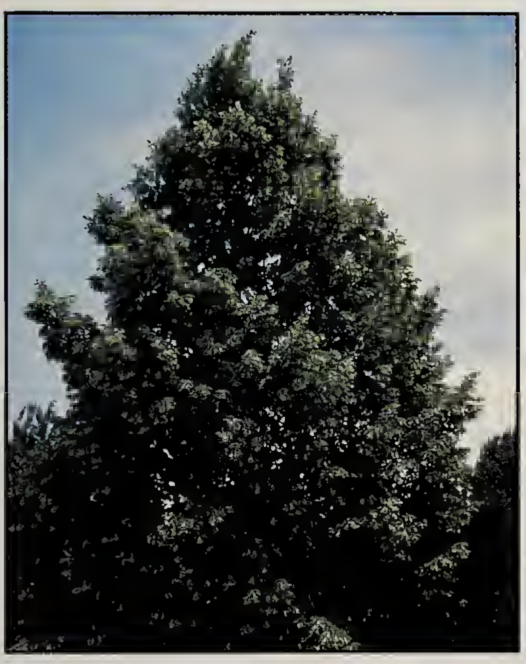

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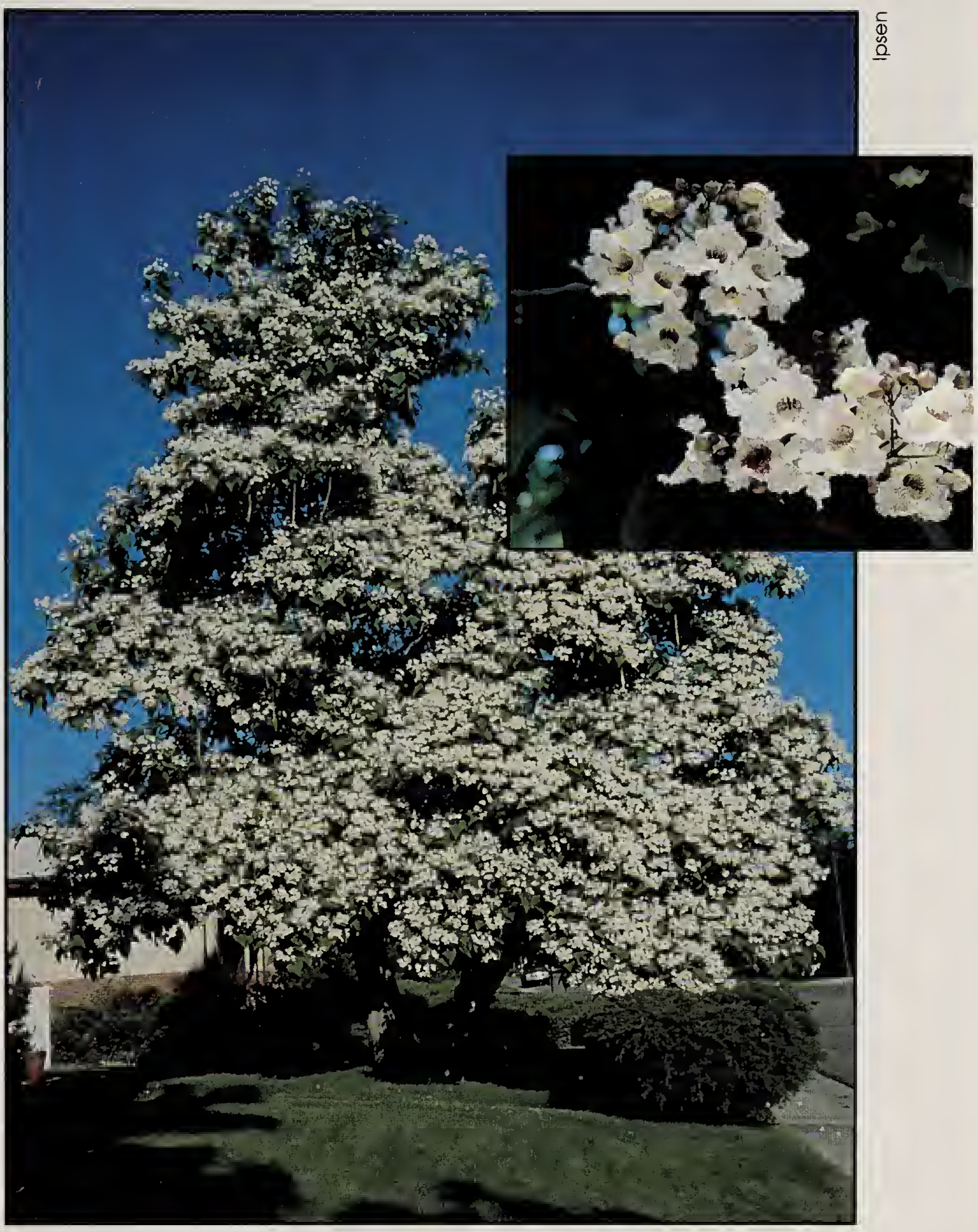

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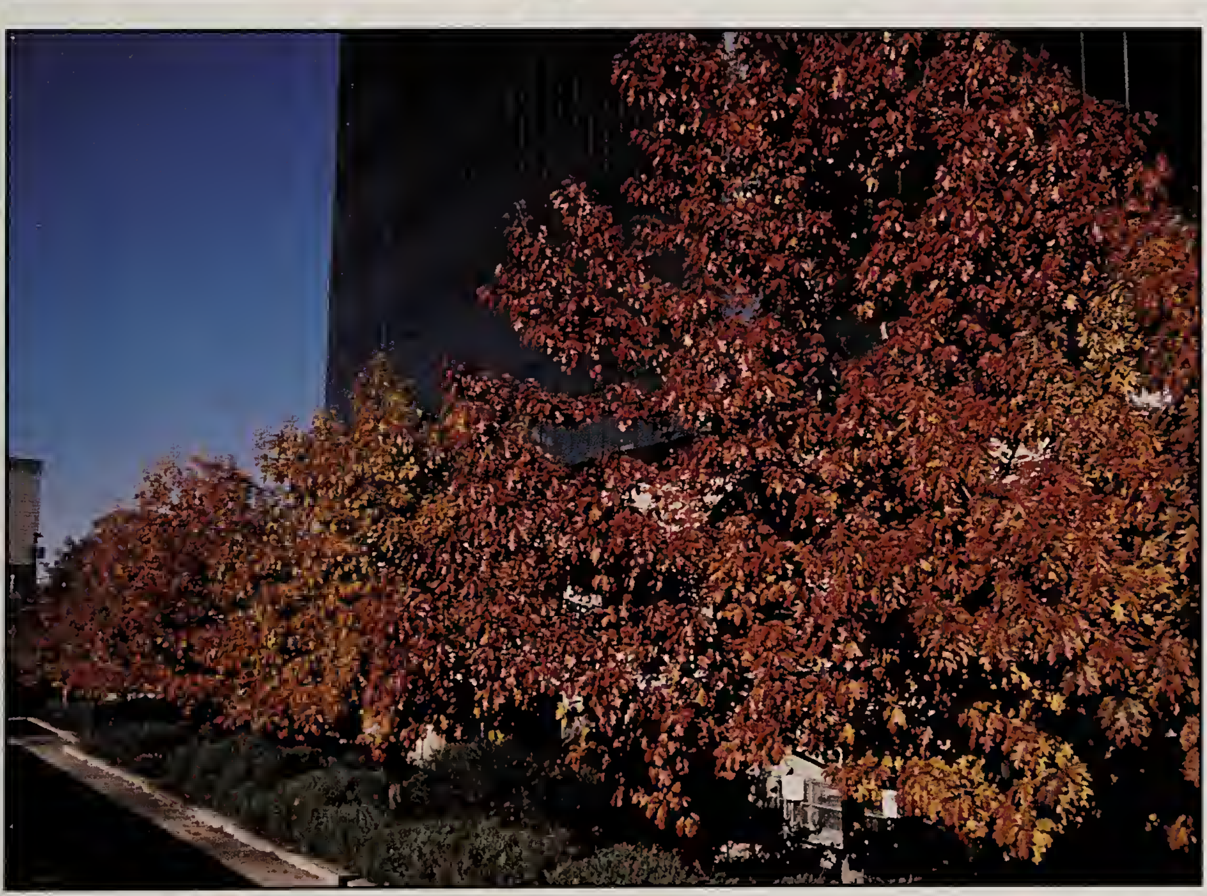


Top left: Cut-leaf weeping birch

Center left: American linden

Left: Oaks in fall color

Above, with inset: Western catalpa

species that are loved and admired by the public. A sensible approach would seem to be to plant for both the long and the short term, including fast- as well as slower-growing species in street plantings. Fast-growing trees generally have weaker growth and shorter lives than slow-growing types. It is important to realize that many tree species believed to be slow-growing often have quite satisfactory growth rates, once established.

It may also be good to reconsider whether the usually brief periods of litter from tree flowers and fruit are really so serious. Northern catalpa (*Catalpa speciosa*) female specimens of Kentucky coffeetree (*Gymnocladus dioica*), Buckeyes (*Aeschulus* spp.), Horse chestnuts (*Aesculus hippocastanum*) and even seed-producing individuals of thornless honeylocust are shunned because of the “mess” their large seeds or pods produce. Older parks, however, frequently have mature specimens of thornless honeylocust, planted before the introduction of seedless varieties, which in fall and winter are laden with dramatically long, twisted, mahogany-colored pods.

Normally, pods will also be found lying on the ground beneath these trees, giving interest to the otherwise dormant, monotonous brown turf and demonstrating nature’s self-perpetuation. And what child hasn’t delighted in a pocketful of shiny “buckeyes” from beneath a horse chestnut or buckeye tree? Continuing the practice of selecting only cultivars with flowerless or seedless characteristics not only makes for a dull landscape with limited seasonal interest, it drastically limits genetic diversity in each species and, as well, limits the food supply for insects, birds and wildlife.

Oaks are considered to be slow-growing but are unquestionably a long-lived, majestic choice for street planting. The genus *Quercus* is large and diverse. Three species that do well as street trees are bur oaks (*Q. macrocarpa*), northern red oaks (*Q. rubra*) and English oaks (*Q. robur*). Other oak species with well established specimens growing in the area deserve wider planting. Among these are swamp white oaks (*Q. bicolor*) and Mongolian oaks (*Q. mongolica*).

Several linden species may be grown in this area. Two of the more common are American lindens (*Tilia americana*) and littleleaf lindens (*T. cordata*). Both are stately trees with pyramidal growth habits when young. Lindens grow into sturdy trees that seldom need pruning. In late June their pale yellow flowers open beneath the dense, green, heart-shaped foliage to delight unsuspecting passersby with their sweetly fragrant scent. ‘Redmond’ linden, a hybrid of somewhat uncertain origin, has reddish bark in winter.

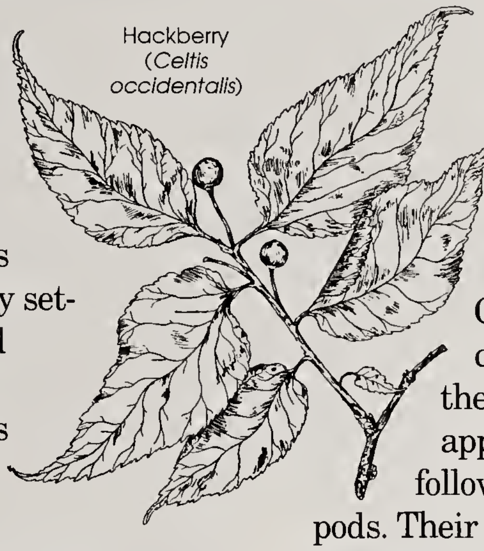
Seldom-encountered but seemingly well-adapted trees for our area are the Turkish filberts (*Corylus colurna*). The filberts, or hazelnuts, are members of the birch family. These trees are reputed to thrive in hot summers and cold winters, and are very drought tolerant once established. They have an attractive form rather like some of the oaks and require little maintenance.

Birches, among the most beloved of trees, have varied success in our area. A decade or more ago it seemed each spring brought the decline and death of numerous mature specimens. A combination of dry winters, borer infestations and old age seemed to be the causes. Most of these losses were specimens of *Betula pendula*, known as European white birch, and *B. papyrifera*, or paper birch. Even under the best of circumstances, most birches cannot be considered long-lived.

Birches are not a common choice for street planting, and it should be noted that the City and County of Denver prohibits the planting of trees in the public right-of-way with weeping or pendulous growth habits, as well as multi-stemmed trees. These are habits common to several birch species. There is, however, one birch which tends to be more trouble free than others and whose growth habit would make it a suitable street tree. This species is the handsome, widely adaptable Eastern river birch (*B. nigra*). Unlike most birches, this rather fast-growing tree is tolerant of dry periods, particularly in the summer and fall, and is resistant to birch borer. Its bark exfoliates into rough, curling plates that are highly ornamental. The cultivar ‘Heritage’ is an excellent, highly recommended tree.

Now, picture a sound tree with an attractive branching pattern, distinctive ornamental bark and bright green foliage that turns yellow in autumn. Some authors describe it as one of the best substitutes for the American elm along our streets. Yet hackberry (*Celtis occidentalis*) remains underused. It is tolerant of a wide variety of soils. It grows well in windy, dry sites. And, although it's a cousin of the American elm, it is not susceptible to Dutch elm disease. Perhaps "nipple gall" on the foliage is a deterrent. It shouldn't be, as this insect-caused problem does little damage to the tree.

Another American tree that is highly adaptable to Colorado soils and climate is the Kentucky coffeetree. Mature specimens are renowned for their handsome, rugged winter silhouette and rough, attractive bark. Female trees produce thick pods containing large seeds that early settlers in this country roasted and ground into a coffee substitute. Another of the tree's advantages in our climate is its tendency to leaf out rather late in the spring, avoiding heavy late spring snow damage. Certainly these are trees that deserve planting outside of public parks, where they are frequently found.


Hackberry
(*Celtis occidentalis*)

Unusual medium-sized trees with potential for street planting are Amur corktrees (*Phellodendron amurense*). They tend to have a picturesque, broad spreading habit so they may need some pruning for street clearance. Among their many desirable characteristics are ease of transplanting, ability to grow in a wide variety of soils, tolerance of drought and urban pollution and low maintenance requirements. The roughly ridged, corky bark on older trees is an important ornamental feature. The trees' tendency to defoliate early in the fall season is an additional advantage in this climate.

There are mixed reviews on sycamores (*Platanus occidentalis*) also known as American planetrees. They are, nevertheless, worthy candidates for a varied urban forest. They are among the taller trees and they grow relatively fast. Most detractors cite their messiness and susceptibility to the disease anthracnose. Anthracnose, however, rarely kills the tree and its seriousness in any year depends on weather conditions. Cool, moist late spring weather favors its spread, so Colorado's usually low relative humidity minimizes the problem.

Sycamores' tolerance of adverse city conditions is one of its greatest assets. The mature line of sycamores on either side of Marion Street Parkway just north of Washington Park, planted decades ago by S.R. DeBoer, is stunning. Aesthetically they are known for their intriguing bark, which exfoliates in smooth patterns in shades of white, gray and brown. Sycamores, also, leaf out somewhat late in the spring.

Several mature Japanese pagoda trees (*Sophora japonica*) in the Denver metropolitan area imply that these trouble-free, pollution tolerant trees may be hardier in Colorado than some references indicate. Also known as scholar trees, their creamy white flower clusters appear unexpectedly late in summer, followed by lustrous yellow-green seed pods. Their compound leaves are somewhat similar but not as finely textured as those of honeylocusts.

Finally, let's ponder whether we must forever forsake the planting of American elms, once the tree-of-choice for streets across much of the country. Even without the threat of Dutch elm disease, the species is not lacking in problems, further illustrating that there is no perfect tree. Work on Dutch elm disease-resistant American elm hybrids and cultivars continues. Whether currently available cultivars will successfully combine disease resistance with the graceful and esteemed vase-shape form remains to be seen. Gamblers may choose from the cultivars 'Washington' or the promising 'Liberty' series.

Trial and error taught early Colorado plantspeople which trees would survive along our streets; adventurous Front Range horticulturists continue the experiment as new cultivars and species become available. A more interesting, healthier urban forest would result if each resident could tell those who inquire of their tree, "Yes, it is quite an unusual species, and the only one I know of in the neighborhood!"

Right: Horse chestnut in City Park

Below left: Hackberry in fall color

Below right: European mountain ash in fall color

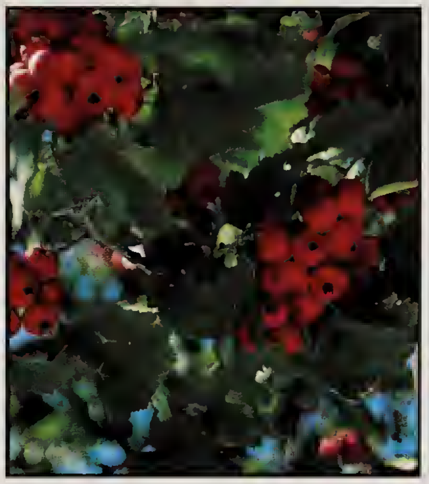
Ipsen

Ipsen

Ipsen

Rollinger

Ipsen



Ipsen

Top left: Littleleaf linden in Washington Park

Above: European mountain ash in fruit

Left: Downy hawthorn fruit

Below: 'Autumn Purple' ash and green ash in the fall

Ipsen

Trees for Small Spaces

Susan Yetter

Ever since losing Eden, people have been busy creating sacred and magical places, called gardens, in which to take refuge from the hectic world. The process of making a garden—from the first internal vision, through the design process and, finally, to the tools and sweat—is about creating a space—ideally one with some poetry to it.

Of the many materials and design elements available to make a garden enclosure, trees can be used as "living architecture" to define the boundaries, form the garden ceiling, frame or screen views, cast shade, or simply be used as centerpieces (focal points) placed where we may appreciate their explosion of blooms, fall colors or interesting textures and structural forms. Glades or woodsy groves create a certain mood in a garden; a formal allée strikes a different mood.

In small gardens where space is at a premium, the selection and placement of trees warrant special consideration. More heartbreak has come from miscalculated placement of trees and underestimating their ultimate sizes than from any other element in the garden. After all, the idea is to create space, places to sit and stroll and explore and gather—not to fill it with space-dominating vegetation.

Having at hand a list of appropriate smaller-scale trees, and understanding their shapes and unique features, a garden-maker will have a better chance of arriving at a sanctuary that functions for its many intended uses and gives sensory pleasure throughout the seasons.

Columnar Trees

Trees with a narrow, upright profile create a strong vertical accent as single specimens; they are also ideal for screens in small gardens.

Upright European Aspen (*Populus tremula* 'Erecta')

Also known as Swedish columnar aspens, these attractive trees are useful for screen planting, small groves or planting as a single specimen. Their growth rate is somewhat faster than that of our native aspens. However, unlike our natives, these do not put out sucker growth. Their leaves have crisp, wavy edges and glow with shades of yellow, orange and red in autumn.

For best growth, plant upright European aspens in full sun in well-drained soil and adequate moisture. They will reach 20 to 30 feet tall, and 8 feet broad. They are useful up to 8,500 feet elevation.

Columnar Norway Maple (*Acer platinoides* 'Columnare' and *A. p.* 'Crimson Sentry')

The form 'Columnare' is a relatively old cultivar dating back to 1855. It is adorned with small, shallow-lobed leaves on branches arrayed at 60 to 90 degree angles from a strong central trunk. Mature trees are 35 to 40 feet tall with a spread of 15 feet.

'Crimson Sentry' is a dense form with dark purple foliage in spring and early summer. It grows 25 feet in height and 15 feet in breadth.

Both forms possess characteristics common to Norway maples: cold hardiness, soil tolerance, the ability to withstand hot and dry weather. They also offer a profusion of spring

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Susan Yetter is a garden designer specializing in regional and sustainable landscapes in harmony with the West's semi-arid climate. She is a regular instructor at Denver Botanic Gardens.

flowers followed by an abundance of winged samaras.

Pyramidal European Hornbeam (*Carpinus betulus* 'Fastigiata')

This is the most widely planted cultivar of the European hornbeam, although it still has not been used much in the Rocky Mountain West. The trees have a formal appearance that is highlighted by their sinewy smooth, grey bark. Of very narrow form when young, they tend to develop into oval-to fan shape as they mature. They do not develop a central leader.

Their foliage, evenly distributed along dense branches, changes from dark green to yellow in late fall. They are remarkably tolerant of city conditions. Young examples may be seen along Speer Boulevard in Denver at the new KUSA-TV building.

They grow approximately 35 feet tall and 15 to 20 feet broad. They thrive up to 6,000 feet elevation.

Capital Pear (*Pyrus calleryana* 'Capital')

Introduced to the nursery trade by the National Arboretum, these are an extremely narrow, upright form of the callery ornamental pears. Their branches are graced with heart-shaped leaves of a lustrous dark green that glow with a coppery reddish purple fire come autumn. In sprint they explode with white flower clusters that produce almost no fruit.

It is reputed to have moderate to good resistance to fire blight. 'Capital' pears reach a height of 30 to 35 feet and a breadth of only 8 to 10 feet, making them a choice substitution for the pedestrian and pitifully short-lived Lombardy poplar. They are hardy up to 6,000 feet.

Columnar English Oak (*Quercus robur* 'Fastigiata')

The stately magnificence of the immense English oaks, in a size suitable for even the smallest garden! Very narrow, upright trees, they have a distinctive upright branching habit as well. They grow 40 to 45 feet tall and 10 feet across.

Their leaves are large, with rounded lobes. They are smooth dark green above and pale bluish green beneath, turning rich russet in the fall. Tending to persist through the winter, the leaves contrast nicely with the deeply furrowed, grey-black bark.

Tallhedge Buckthorn (*Rhamnus frangula* 'Columnaris')

The narrowest of the narrow, these dense plants grow to 15 feet high and a mere 3 to 4 feet across.

Their dark, glossy green, oblong leaves arranged alternately along slender branches turn rich yellow in fall. In early spring they produce a haze of creamy white, nearly inconspicuous flowers that ripen to pea-sized fruit in midsummer, red first, then glossy black.

Weeping or Pendulous Trees

Gracefully arching trees are of structural interest as accents, focal points or an "Oriental" feeling.

Weeping Purple Beech (*Fagus sylvatica* 'Purpurea Pendula')

These are broad, dome-shaped trees prized for stunning foliage of deep purple in early spring that becomes rich green-purple in midsummer. In winter their bare branches arch to the ground in a weeping framework that creates a focal point with dramatic impact.

They are slow-growing trees and, like all beeches, are shallow-rooted. A site in light shade would be ideal for them, as the dark leaves tend to burn at high altitudes; protection from the desiccating effects of winter winds is essential. Growing to 15 feet tall, they spread to 20 feet.

Weeping Mulberry (*Morus alba* 'Pendula' or *M. a.* 'Chaparral')

This cultivar of the white mulberry is of relatively short stature with slender, weeping branches that form a deep, umbrella shaped crown. They reach a height of 10 to 15 feet and a spread up to 20 feet.

The bright green foliage becomes yellow in

Ipsen

Columnar maple

autumn; when they fall they reveal a gnarled pattern of naked branches. Generally, these are fruitless trees.

Camperdown Elm (*Ulmus glabra* 'Camperdownii')

The scion wood of these grafted trees originated from a seedling found outside Camperdown House near Dundee, Scotland, at the beginning of the 19th century. From their rounded crowns emanate pendulous branches of deeply toothed, dark green leaves, slightly hairy on their undersides. These unusual trees are slow-growing and difficult to obtain.

Trees for Seasonal and Structural Interest

Trees with strong structural character are excellent for intimate spaces; these are highly ornamental in several seasons.

Apricot (*Prunus armeniaca*)

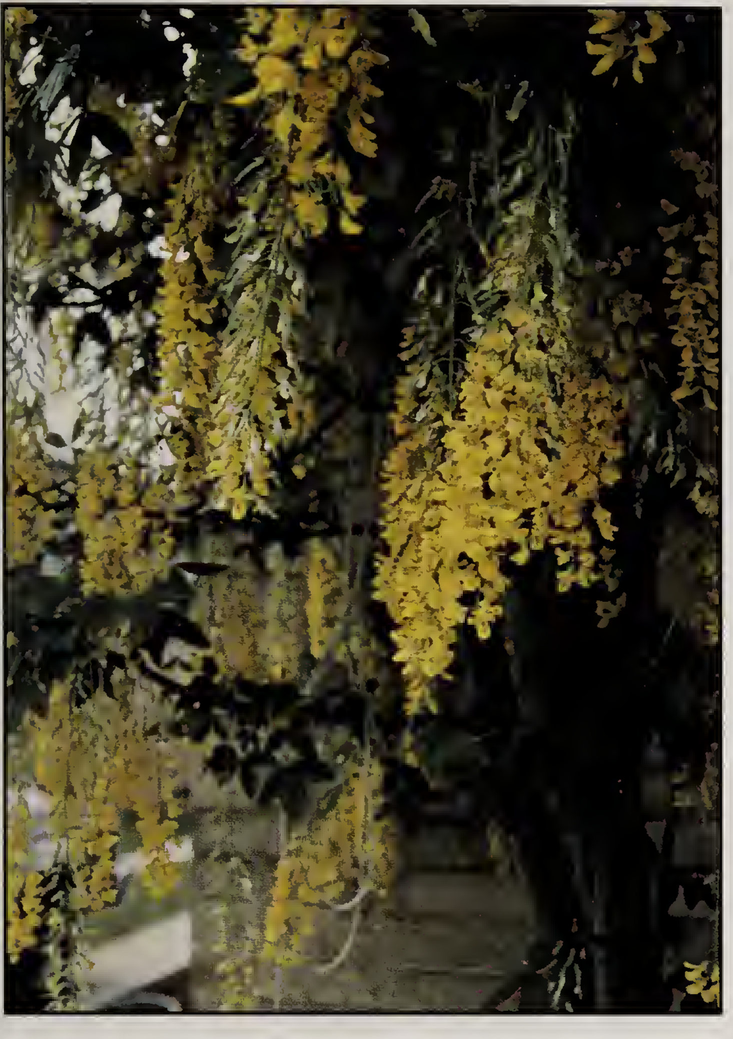
This is a drought-tolerant species. The trees, rounded-to-vase-shaped, provide a spreading canopy of heart-shaped leaves that are tinged with orange as they emerge, then darken to a rich, lustrous green. Their pink flowers are among the first to awaken in spring and are often bitten by frost, so these are unreliable fruit trees. They are, however, no less ornamental. Warm orange with splashes of red are the autumn colors of their leaves. As broad as they are tall, they grow to 25 feet.

Amur Chokecherry (*Prunus maackii*)

A vision of shiny, peeling, cinnamon bark against a pure white blanket of snow—these trees are winter poems. They have an interesting, rounded shape, with muscular branches sporting white flower clusters in spring followed by small red fruit that matures to black in late summer. Birds quickly gobble down the fruit! Cultural considerations are well-drained soil and a sunny location. They reach a height of 20 to 25 feet and a spread of 15 to 20 feet.

European Mountain Ash (*Sorbus aucuparia*)

For a ferny, somewhat tropical appearance, plant these small trees with pinnately


Ipsen

Golden chain tree

compound leaves. Their large, white May flower clusters give way to clusters of orange or red-orange berries that persist into winter. Their bark is a rich, dark coppery skin with a shiny cast that seems to intensify in fall when the leaves turn to bright orange-red.

Very well-drained soil is necessary for these trees to thrive. They are exceptionally cold-hardy root systems and can be grown up to 9,500 feet elevation. Some of Colorado's premier nurserymen suggest they would be suitable choices for growing in large containers.

The cultivar 'Cardinal Royal', an ideal columnar tree for small gardens and hedging, grows only 10 to 15 feet broad. 'Black Hawk' is more broadly columnar. Both cultivars grow 20 to 30 feet tall.

Hawthorns

As a group the hawthorns are excellent hardy small trees for this region. They are remarkably tolerant of many soils, but prefer their site to be well-drained and in full sun to light shade. They produce a profusion of spring flowers and ornamental, persistent fruit, then continue the year with outstanding autumn coloration and craggy winter forms.

Ipsen

Looks are deceptive: Although young Lombardy poplars seem to be ideal trees for narrow spaces, they prove troublesome on the High Plains, and should not be used.

Russian Hawthorn (*Crataegus ambigua*)

These vase-shaped trees have a characteristic crooked or twisted aspect. Their deeply incised leaves of glossy green turn orange to red in fall. Their rugged winter form is accented by small red fruit against a mass of thorny branches. Quite drought tolerant, they grow 15 to 25 feet tall and nearly as broad. They are suitable up to 8,000 feet elevation.

Thornless Cockspur Hawthorn (*Crataegus crus-galli* 'Inermis')

The spreading crowns of these small trees have a distinctively horizontal branching habit, giving them a layered look. Their pea-sized red fruits hang well into autumn, accenting their deep purple-red fall foliage. Growable up to 8,000 feet, they are as broad as they are tall—up to 20 feet.

Winter King Hawthorn (*Crataegus viridis* 'Winter King')

Distinguished by a vase-shaped, angular form, broader than tall, these trees also have shiny green foliage—changing to simmering purple to scarlet—and lovely silver-grey bark. Sparse thorns occur throughout their dense branches. Up to 6,500 feet they grow 15 to 20 feet in height and spread to 25 feet across.

Magnolias

Yes, three magnolias do bloom in Colorado! The key is preparing the soil well and putting the plants in the right spot.

Best locations for magnolias are in full sun or partial shade away from direct winter winds. Avoid a southern exposure because of the extreme fluctuations in spring temperatures that we encounter here: Warm early-spring weather may encourage magnolias' flower buds to open prematurely only to be nipped when winter reasserts itself.

A well-draining soil amended with compost is also paramount. Magnolias take hold somewhat slowly, and care must be taken to water them regularly during dry winter months.

Merrill Magnolia (*Magnolia* x *Loebneri* 'Merrill')

These are free-flowering magnolias with an upright, pyramidal structure, to 20 feet tall and 15 feet broad. They grow well to 6,000 feet elevation.

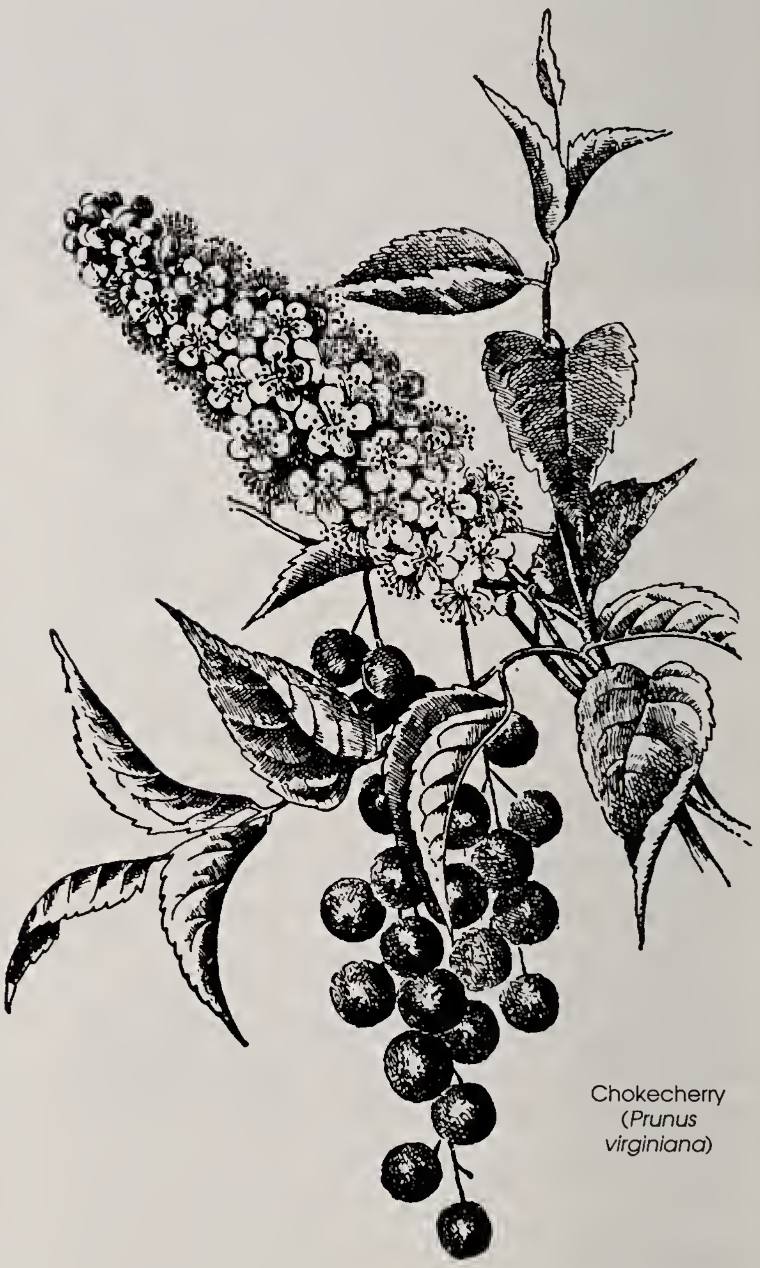
It is breath-taking to see them laden with 15-petaled flowers in early spring like earthbound clouds. Each flower is about three and one-half inches across. The dark green, oval leaves emerge shortly after this spectacular display, then the flower buds for next spring are set and remain on the tree like giant furry catkins through the long winter months.

Saucer Magnolia (*Magnolia* x *soulangiana*)

Compact, rounded trees to 25 feet in height and breadth, their flowers are, indeed, saucers—an incredible 5 to 8 inches in diameter! They open in early spring, blushed old-rose on the outside, opening to creamy white. Their silky silver-grey buds shimmer luminously all winter.

Star Magnolia (*Magnolia stellata*)

The large (3- to 4-inch) white flowers of these small trees emerge from their velvety buds in early spring with an intense, gardenia-like fragrance, their wavy petals curling back into a many-petaled star. The leaves are dark green and shiny above, light green on their undersides. The trees grow only 10 to 15 feet tall and across. They are hardy to 6,000 feet.



Chokecherry (*Prunus virginiana*)

Alley Cat Trees

Rob Proctor

Alley cats have earned reputations for being tough. The riffraff vegetation known as "alley trees" shows the same tenacity to survive. They get by on limited food, space and water, taking the abuses of weather extremes without help from us. They are at the mercy of garbage trucks, power line crews and waste tossed at their feet.

Few of us pay much attention to our alley vegetation. We usually have our hands full pampering the plants in our civilized gardens. Outside our walls or fences, plants must survive on their own. Most of their roots are buried under asphalt and concrete, and reflected heat from pavement and the sides of buildings bakes them in summer. Yet some survive and even thrive—while the pampered garden plants may succumb!

My appreciation for alley trees started years ago in my old backyard. A tree-of-heaven (*Ailanthus altissima*) grew there, as in Brooklyn—its 40-foot trunk rising out of slabs of buckled concrete. A female, it shed abundant seeds each year that sprouted vigorously around my garden. Several times I thought of chopping it down, but I had to consider the consequences.

Now most trees are "messy." That's their job: to make fruits or seeds to propagate themselves. I never understand people who complain about seeds, leaves, fruit—and even blossoms—falling on their pristine patios and walks, as if the producers are misbehaving. That's nature. I heard of a couple who chopped down a magnificent redbud near their front door because the blossoms blew indoors as they came and went. Surely, there are worse things in life than a gentle rain of pink blossoms each spring, and I can't imagine fussing over a few in the foyer.

My tree-of-heaven offered no gift quite so lovely, but it served several beneficial functions. Its arching branches shaded the neighborhood dumpster, no doubt sparing all of us on the block the stench of sun-ripened garbage. It also blocked my view of a particularly unattractive high-rise apartment. Constructed in the sixties, a decade that fails to impress me with its architectural achievement, this building got my vote as one of the ugliest structures on Capitol Hill. The tree-of-heaven blessedly obscured it from sight as I sat on my patio. Chopping down the tree would have meant an even bigger task—dynamiting the apartment building.

So the tree-of-heaven remained, still not my favorite, seeding itself like mad—but I began to respect its handsome, pest-free leaves and appreciate the red tint of its chartreuse seed heads as summer waned. I've moved from that garden, but my new alley sports a tree-of-heaven, even bigger than the last. I'm sure I'll be pulling up its seedlings until the end of my days, but there are worse fates—such as having a Siberian elm in your alley. I have those too.

Siberian elms lack most of the attributes of a desirable tree. About the best thing I can say is, that they provide shade. The metropolitan area discovered a couple of years ago that they're not quite as tough as their name implies, when thousands of them died after the infamous autumn temperature crash, when 90-degree weather dropped to nearly zero in 24 hours. Crews are still taking out the dead Siberians.

A prolific writer and former editor of *Mountain, Plain and Garden,* Rob Proctor is the author of a series of books on antique flowers. His "Front Range Gardeners" column appears regularly in *The Denver Post.*

The leaves of the survivors are chewed each year by insects and, although this species is not susceptible to Dutch elm disease, its dead wood does harbor the beetles that carry the disease to American elms.

Other alley trees vary from neighborhood to neighborhood—all of them more desirable than Siberian elms. Catalpas are some of my favorite trees—in the alley or otherwise. I love their exotic, fragrant flowers and large, heart-shaped leaves. There's still boy enough in me to appreciate their long, thin pods, so perfect for sword fights.

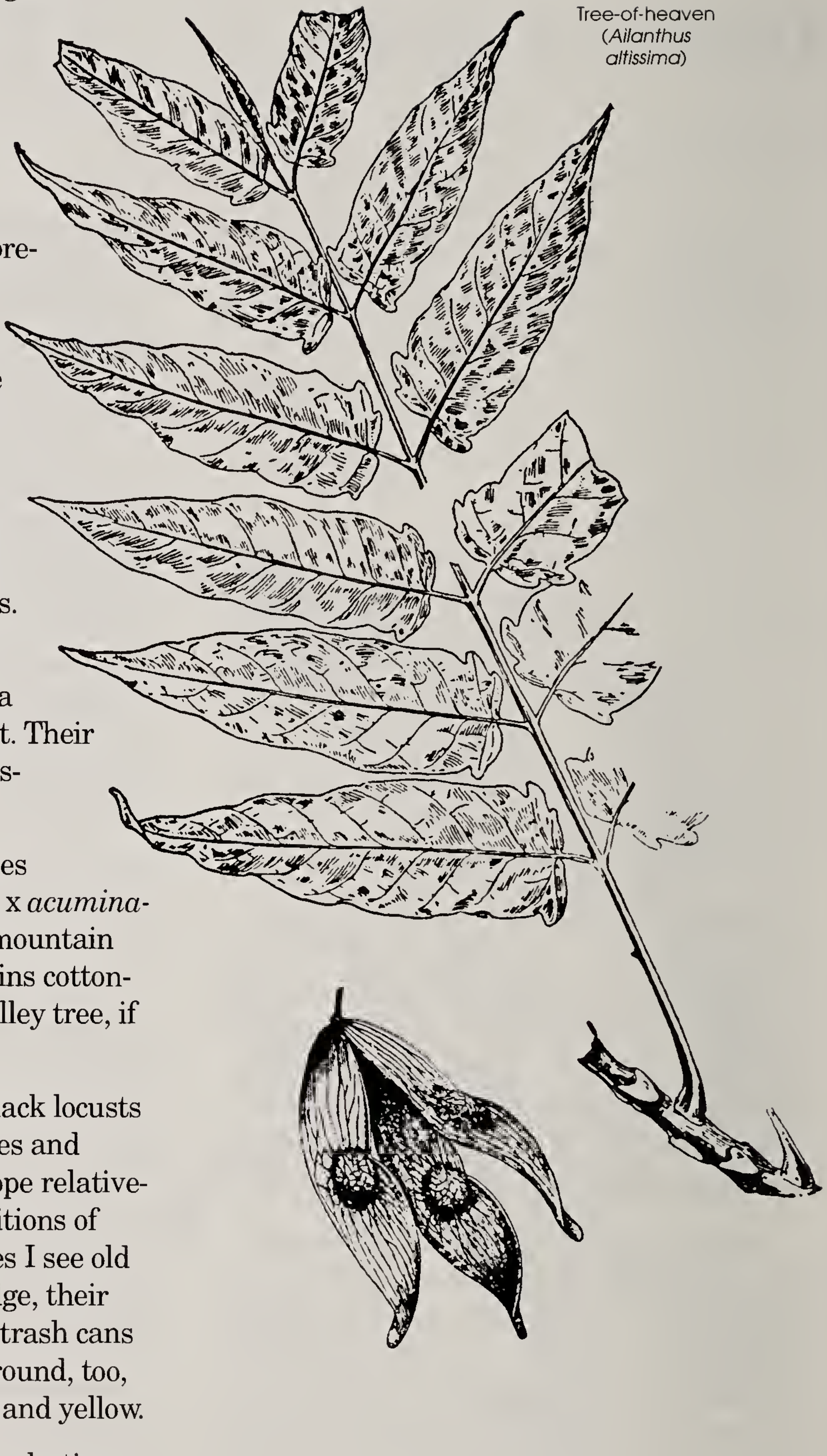
Box elders, an old native of the plains, take the rigors of city life in stride. It's best to have them far away from the house, anyway, if the sight of their omnipresent black and red box elder bugs disturbs you, even though the insects are harmless.

Old Russian olives sometime soften our alleys, their silver foliage a nice contrast to brick and spray paint. Their fragrance floats on spring breezes, disguising more pungent alley aromas.

Cottonwoods, too, are sometimes found, especially the hybrid *Populus* x *acuminata,* a cross between the narrow-leaf mountain species (*P. angustifolius*) and the plains cottonwood (*P. deltoides*). It is a first-rate alley tree, if there is such a thing.

Old ashes, honeylocusts and black locusts shade alleys in older parts of the cities and towns long the Front Range. They cope relatively well with the less-than-ideal conditions of alley life and are an asset. Sometimes I see old fruit trees living their lives on the edge, their fruit-laden branches bending across trash cans and chain link. Chokecherries are around, too, their autumn leaves turn to maroon and yellow.

Gardeners take great pains in selecting plants for their gardens, but ignore their alleys. We visit the dumpster or back out of the garage almost as often as we collect the mail. Perhaps we should pay more attention to, and pause to appreciate, the trees that we pass beneath every day, among the refuse and alley cats.



Tree-of-heaven
(*Ailanthus altissima*)

Blossoms Through the Year

Late Winter

Witch Hazel	*Hamamelis* species
Cornelian Cherry	*Cornus mas*
Goat Willow (Pussy Willow)	*Salix caprea*

Early Spring

Wild Plum	*Prunus americana*
Eastern Redbud	*Cercis canadensis*
Shadblow Serviceberry	*Amelanchier* spp.
Magnolia	*Magnolia* spp.

Mid-Spring

Newport Plum	*Prunus cerasifera* 'Newport'
Crabapple	*Malus* spp.
Apple	*Malus* spp.
Bradford Flowering Pear	*Pyrus calleryana* 'Bradford'
Bird Cherry	*Prunus padus* 'Alberti'
Schubert Chokecherry	*Prunus virginiana* 'Schuberti'

Late Spring

Hawthorns	*Crataegus* spp.
Sour Cherry	*Prunus cerasus*
Mountain Ash	*Sorbus aucuparia*
Yellow-Wood	*Cladrastis lutea*
Golden Chain Tree	*Laburnum anagyroides*

Early Summer

Chinese Catalpa	*Catalpa ovata*
Western Catalpa	*Catalpa speciosa*
Ohio Buckeye	*Aesculus glabra*
Yellow Buckeye	*Aesculus octandra*
Horse Chestnut	*Aesculus hippocastanum*
Chinese Tree Lilac	*Syringa pekinensis*
Japanese Tree Lilac	*Syringa reticulata*
Hop Tree, Wafer Ash	*Ptelea trifoliata*
American Linden	*Tilia americana*
Littleleaf Linden	*Tilia cordata*

Midsummer

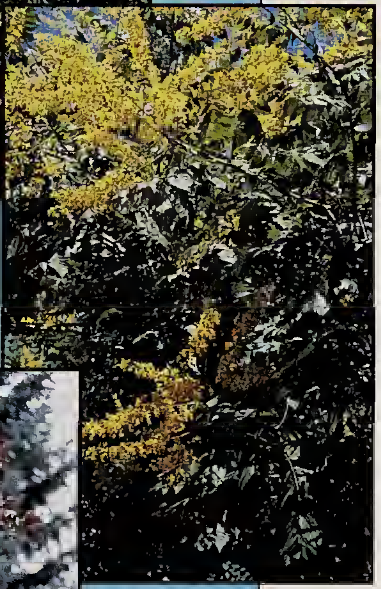
Goldenrain Tree	*Koelreuteria paniculata*

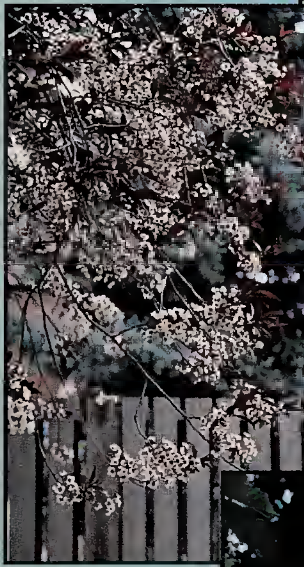
Late Summer

Japanese Pagoda Tree	*Sophora japonica*

Chinese tree lilac

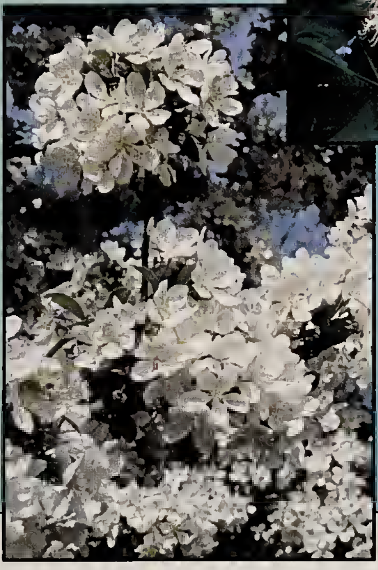
Goldenrain tree





Newport plum

Horse chestnut



White crabapple

Demystifying the Maples

Larry Watson

Among the almost 200 species of the genus Acer (maple) the only consistent similar feature is their winged seeds. Most maples are deciduous and many color brilliantly in autumn. Beyond that, variety is the theme in the world of maples.

Their beautiful foliage ranges from the familiar hand-shaped leaf of the big solid North American species, such as sugar maple, to more delicate, filigreed foliage of the Eastern Asian maples. Barks, too, vary, and forms run the gamut from stately shade trees to shrubby plants.

Maples have been and continue to be of horticultural importance—some member of this diversified, hardy and easily cultivated group is grown nearly everywhere in the United States.

As a general rule, maples are sun lovers and prefer rich, moist soils. Many are sensitive to alkaline or heavy, poorly-drained soils. In the Rocky Mountain West sunny locations are not hard to find, but rich soils are exceptions and difficult to manufacture. Silver maple and ginnala maple often display the yellowing of chlorosis when they are grown in areas of heavy clay.

A few maples find our climate too severe, such as the Japanese maple group, although an individual may grow for a while in a sheltered location. Despite these selective limitations, the maple continues to be an important genus in our region.

The many species within the genus have had numerous selections developed over the years and their names can be confusing to the average tree buyer. For example, how does 'Royal Red' differ from a 'Red Sunset'? They are actually varieties of two different species. One is a Norway maple and one is a red maple.

Certain selections are better than others for the Rocky Mountain West. Some old favorites have been replaced by newer cultivars. Considering these confusions, it will be helpful, in the discussion that follows, to sort out some of the best cultivars of the various species that can be grown in our climate.

Shade Tree Maples

Box elder (*Acer negundo*)

This maple is an extremely hardy North American species (USDA Hardiness Zone 2). It is one of the hardiest of all the maples and has been used for years in shelter belts. It is also thought of as being a "weed" tree, in the same class as Siberian elm and tree of heaven. This is unfortunate. Box elders thrive in adverse conditions in extremely harsh locations; with irrigation there are a few selections of this tree well worth considering.

A. negundo 'Baron' is a 35- to 40-foot tree with an upright, oval shape and a spread of about 30 feet. It is a selection from the Morden Station in Canada and was introduced by the Canadian Ornamental Plant Foundation. This male selection produces no seeds.

A. n. 'Flamingo' will attain a height and width of about 30 feet. It exhibits showy foliage of pink, white and green variegation.

A. n. 'Variegatum' is about 25 feet tall and 20 feet wide and has variegated, creamy white and green leaves. The fall color is yellow.

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Sensation box elder (*A. n.* 'Sensation') grows 30 feet tall and 25 feet wide and has brilliant red fall color.

Norway maple (*A. platanoides*)

This European species has been in production since the 1700s. Hundreds of selections have been made for form, leaf color, size and adaptability or ease of growth. Many of the selections are difficult to distinguish, while others are very distinctive. A list of all the selections of Norway maple would make for tedious reading, so the following only hits the highlights:

The Columnar Norway maple (*A. platanoides* 'Columnare') will reach a height of 35 feet and will be about 15 feet broad. It has a narrow upright form with ascending branches. It can be grown branched to the ground or pruned to a standard. It has the usual dark green foliage of the Norway maple and the typical yellow fall color.

The Crimson King Norway maple (*A. p.* 'Crimson King') will reach a height of 40 feet and a width of 35 feet. The leaves of Crimson King emerge deep purple and remain that color through the growing season.

Royal Red Norway maple (*A. p.* 'Royal Red') is a selection of the Crimson King maple. Some growers say it is no different from Crimson King; others claim it is somewhat hardier.

Crimson Sentry maple (*A. p.* 'Crimson Sentry') also has deep purple coloration but it will only reach a height of about 25 feet with a spread of 15 feet. It can also be grown branched to the ground or as a standard.

Deborah maple (*A. p.* 'Deborah') is the variety that has replaced the Schwedler maple. It grows 45 feet tall and 40 feet wide. Its foliage is reddish purple in the spring and dark bronze-green in the summer. Deborah maple is actually a seedling of Schwedler but growers feel it has a better branching habit and is less susceptible to leaf tatter than Schwedler.

The silver variegated maple (*A. p.* 'Drummondii') will attain a height of 35 feet and a width of 25 feet. It has very striking light green leaves with creamy white margins. The variegated maple will grow more slowly than some other forms. It can also show some scorching if planted in a hot, sunny location.

Globe Norway maple (*A. p.* 'Globosum') is a nearly perfectly round tree. It is often grown on a standard, but sometimes is not tall enough to walk under.

Princeton Gold Norway maple (*A. p.* 'Princeton Gold') has bright yellow foliage throughout the summer and yellow fall color.

The preceding list represents some of the unusual forms and leaf colors available in a Norway maple. In addition, there are the standard green-leaf types, all about 40 to 50 feet tall and 25 to 40 feet wide. The merits of these various forms are debated among tree experts, but it will make little difference which of these Norway maples you use: all have dark green foliage and yellow fall color. The more common, named selections are:

Cleveland Norway maple (*A. platanoides.* Cleveland')

Crystal Norway maple (*A. p.* 'Lamis')

Emerald Queen Norway maple (*A. p.* 'Emerald Queen')

Emerald Lustre Norway maple (*A. p.* 'Pond')

JadeGlen Norway maple (*A. p.* 'JadeGlen')

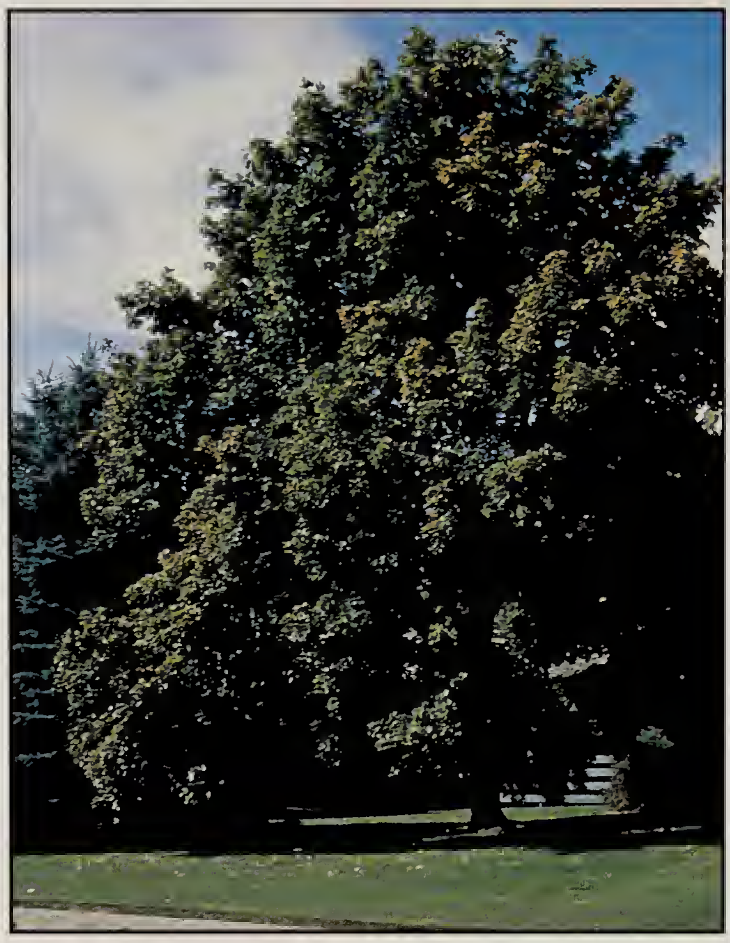
Parkway Norway maple (*A. p.* 'Columnarbroad')

Summershade Norway maple (*A. p.* 'Summershade')

Superform Norway maple (*A. p.* 'Superform')

Sycamore maple, planetree maple (*Acer pseudoplatanus*)

This very large tree—to 60 feet—is native to Europe. Mature, it has an oval to rounded head 40 to 50 feet wide. The reason for its name is the resemblance of its leaves to those of the sycamore (*Platanus occidentalis*). This plant has a hardiness rating of Zone 5, which makes it slightly risky in some parts of the Rocky Mountain West, but there are some very old, large plants in Boulder and Colorado Springs. It prefers good drainage but is adaptable to most soils and is salt tolerant. Although there are many selections listed in reference books, only the Spaeth sycamore maple (*A. pseudoplatanus*



Ipsen

Sugar maple

Ipsen

Ginnala maple in fall

'Atropurpureum') seems to be in the trade. The Spaeth sycamore maple has foliage which is dark green above and rich purple beneath.

Red maple, scarlet maple, swamp maple (*A. rubrum*)

The native range of red maples extends from Newfoundland to Florida, west to Minnesota, Iowa, Oklahoma and Texas. The red maple has something red about it in most seasons. Red winter buds open early in the spring to a showy display of red flowers against light gray bark. Emerging leaves are tinted red, and in fall the fiery leaves almost rival those of sugar maple, accounting for a large amount of the orange-red fall color in the East.

Red maples are fast-growing trees that reach a height in this area of 50 to 60 feet. The species grows about 35 to 40 feet wide. It is happiest in moist, well-drained soil; it does not do well in alkaline soils. Because of its extensive native range, many selections of red maple have been made for different parts of the country, as well as for fall color and form. It is my feeling that in the Rocky Mountain region, we need to pay particular attention to *A. rubrum* selections taken from the colder climates. All three of the following selections are from Northern Minnesota. They will grow to about 50 feet tall and 30 to 40 feet wide. All have a good branching habit and bright red fall color.

Firedance maple (*A. r.* 'Landsburg')

Northwood maple (*A. r.* 'Northwood')

Northfire maple (*A. r.* 'Olsen')

Autumn Spire Red maple (*A. r.* 'Autumn Spire')

Also from Minnesota, this selection will reach 50 feet with a spread of only 20 to 25 feet for its growth habit is broadly columnar. It also exhibits beautiful red fall color.

Acer x *freemanii*

I have refrained until now from discussing this group of plants. Many horticulturists, taxonomists, and dendrologists have found what they consider to be natural hybrids of red maple (*A. rubrum*) and silver maple (*A. saccharinum*). The natural ranges of these two species overlap in many parts of the United States. In addition to these natural crosses, other crosses have been made by plant breeders. This entire group has now been labeled *Acer* x *freemanii*.

Since this classification is relatively new, some varieties will be listed in one reference as *A.* x *freemanii* and in another as *A. rubrum* or *A. saccharinum* selections. These selections may exhibit characteristics of either or both parents and may be superior because of the positive traits of silver maple (*A. saccharinum*). Below are but a few of the more than 200 identified selections of this hybrid.

Autumn Blaze maple (*A.* x *freemanii* 'Jeffersred') was selected by Glen Jeffers. This one will reach a height of 50 feet and a width of 40. It has an upright-branching, broadly oval habit. The original tree is believed to be in Ohio. Its fall color is brilliant orange-red.

Armstrong maple (*A.* x *freemanii* 'Armstrong') is a fast-growing maple with a spire-like appearance. It will reach a height of 50 feet and a width of about 15. The leaf of Armstrong maple looks more like silver maple than the red maple. Fall color is not as good as that of the red maple.

Celebration maple (*A.* x *f.* 'Celzam') is another fast-growing maple. It looks much more like the silver maple than the red maple, reaching a size of about 45 feet by 25 feet. The fall color of Celebration maple is mostly yellow.

Scarlet Sentinel maple (*A. rubrum* 'Scarsen') although listed as a red maple, is now thought by most to be a hybrid. The form on this hardy 40-foot by 20-foot tree is broad at the base, but columnar. Fall color is yellow-orange to orange-red.

Silver maple, soft maple (*Acer saccharinum*)

Silver maple is a common North American species. It grows from Quebec south to Florida, west to Minnesota, Nebraska, Kansas and Oklahoma. It is rated as a Zone 3 plant and normally reaches a height of 60 feet and a spread of 40 to 50 feet. The silver maple is a very rapidly growing tree, making it more brittle and subject to breakage. It is more tolerant of alkaline soils than red maple but this does not mean that it is happy in alkaline soils. The fall color on silver maple is a lovely yellow. There are only a few selections of silver maple in general production.

Silver Queen maple (*A. saccharinum* 'Silver Queen') is a seedless selection and a more uniform tree than the species: It will grow 50 feet tall, with a spread of 40 feet. Fall color is yellow.

Skinner's Cutleaf maple (*A. s.* 'Skinneri') is, in form, the same as Silver Queen maple. The difference is that it has neat, cutleaf foliage. This makes a very attractive tree, one with a distinctive texture discernible even from a distance.

Sugar maple, hard maple, rock maple (*Acer saccharum*)

Sugar maple is a widely planted North American tree, rated Zone 3. Its natural range is from Eastern Canada to Alabama, Mississippi and Texas. The tree is impressive in size, though in our area it will probably not reach more than 50 feet. Sugar maple has a dense regular habit, with dark green leaves that turn yellow-orange and orange-red in the fall. There are some 25 to 30 known cultivars of sugar maple; only a few will be listed here.

Bonfire sugar maple (*A. saccharum.* 'Bonfire') is a selection from Princeton Nursery. It is a vigorous grower with vibrant dark green foliage and good heat tolerance. It exhibits brilliant carmine red fall color. Bonfire will grow 50 feet tall by 40 feet wide.

Commemoration sugar maple (*A. s.* 'Commemoration') was selected by W. N. Wandell and patented by Moller's Nursery in Gresham, Oregon. It, too, is a rapid, vigorous grower to about 50 feet with a spread of 35 feet. Foliage is glossy, dark green; it turns orange to orange-red in the fall.

Green Mountain sugar maple (*A. s.* 'Green Mountain') was patented by Princeton Nurseries in 1964. This tree has an upright oval form and orange-scarlet fall color. The waxy protective coating on its leaves is more than double the thickness of that of regular sugar maple, and its leaves are less likely to tatter in hail and wind.

Legacy sugar maple (*A. s.* 'Legacy') was introduced by W. N. Wandell. This tree also has thick leaves resistant to tearing, is fast growing and is more heavily branched than other sugar maples. Fall color is red, orange and yellow.

Smaller Ornamental Maples

Hedge maple (*Acer campestre*)

Hedge maple is native to Europe and western Asia. It can be grown as a large shrub or small tree. As a tree it can be expected to reach 25 to 35 feet tall with a spread of about 25 feet. It has a USDA hardiness rating for Zone 4. Foliage of hedge maple is deep, dark green that turns yellow in fall. The bark is deeply furrowed or corky. Hedge maple is very tolerant of alkaline and compacted soils. This tree has not been extensively planted here but there are some quite old specimens in the area. The hedge maple demands more attention for our landscapes.

Amur maple, ginnala maple (*Acer ginnala*)

The Amur maple is native to China, Manchuria and Japan, and was introduced into Western cultivation in the late 1800s. This is an extremely hardy Zone 2 plant, grown as a large shrub or as a small patio or specimen tree. It is good for massed plantings. As a tree, with either single or multiple trunks, it will grow 20 to 25 feet tall and about as wide, with an irregular habit. Amur maple is fast-growing and slightly brittle.

Its leaf is identified by the dominant long central lobe. The fruit (seed) is normally conspicuous and red during summer, and fall leaf color is brilliant orange and orange-red.

This maple is somewhat intolerant of alkaline and heavy clay soils. It tolerates shade better than most maples, and it's a good choice for higher elevations, growing up to 10,000 feet. Additionally, it is reported to be one of the best maples to grow above ground in a container. Both of the following selections have been made to ensure a more uniform plant with red fruit and red fall color: Embers Amur maple (*A. ginnala* 'Embers'), Flame Amur maple (*A. g.* 'Flame').

Rocky Mountain maple (*Acer glabrum*)

The Rocky Mountain maple is native from Montana and South Dakota to California and New Mexico. It grows in the lower foothills of the Colorado Rocky Mountains, usually in rocky soil. It is mostly multi-stemmed in the wild but can be trimmed to a single stem. Rocky Mountain maples reach a height of 20 to 30 feet with a spread of 15 feet. The petiole or leaf stem of the Rocky Mountain maple is bright, showy red and the bark is ash gray. The leaves turn yellow in the fall.

Bigtooth maple, Wasatch maple (*Acer grandidentatum*)

The bigtooth maple is native to Wyoming, New Mexico and the Wasatch Range in Utah, where it is the dominant tree. It usually is low-branched or has multiple trunks. It will grow to a height of 20 to 30 feet, with a width of 15 to 20 feet, and is actually more like a large, space-dominating shrub than a tree.

Bigtooth maple tolerates highly alkaline soils and has excellent drought tolerance. Its pretty leaf is like a small version of a sugar maple leaf, and fall color can also be similar: brilliant red-orange. However, it should be noted that fall color is variable within the species. Some plants display only dull yellow leaf color and it might be wise to purchase this tree in the fall when you can see what you're getting.

Tatarian maple (*Acer tataricum*)

Tatarian maple comes from southeast Europe and west Asia. In many ways it looks like Amur maple. It will reach a height of 30 feet and a spread of 20 feet. It, too, can be grown as a tree or a large shrub. The leaves are bright green in summer and yellow in fall. The red fruit in summer is very attractive. Tatarian maple is very tolerant of alkaline soils. At least one reference book refers to a selection which has red fall color (*Acer tataricum rubrum*), but I have never been able to locate it.

Although there are a few other species of Acer growing in this area, some may be less hardy; others are shrub-like. With the wide range of maples suitable for our conditions, every homeowner could grow at least one.

Crabapple Update for the Front Range

Gary Epstein

For many people the beauty of full-flowered crabapples is unrivaled by any other tree or shrub in Colorado. In streets and yards up and down the Front Range, the spring arrival of the pink and white blossoms lifts our spirits.

Earlier attempts to line avenues with Japanese cherries and other less hardy, spring-flowering ornamental trees failed, but the flowering crabapples (*Malus* sp.) stepped right in and demonstrated their ability to tolerate our peculiar and harsh climate.

During my more than 20 years in the Colorado nursery business I have learned that crabapples are a complex and diverse group of trees. Across the country somewhere between 400 and 600 different types of crabapples are known. Their diversity is exhibited not only in blossom and fruit color, but also foliage tint and even leaf shape. New cultivars are being introduced all the time.

This, coupled with ongoing disease research, makes the title of this article somewhat suspect: Any information you read about crabapples could be revised at any time. But for now, this is our most up-to-date assessment.

When choosing a crabapple variety for the Front Range you must keep in mind that Colorado horticulture is a different breed of cat. In my early years in the nursery business, I often had the good fortune to hear the late George Kelly, former acting director of Denver Botanic Gardens, speak at the Colorado Nurseryman's Association meetings. Long considered the guru of Rocky Mountain horticulture, George devoted his life to understanding the peculiarities and frustrating disappointments one experiences gardening in this part of the country.

He once said, "When it comes to reading about horticulture you might as well throw away the books written by those Easterners who live in places with four distinct seasons, 30 inches of annual precipitation, and rich, humusy, acid soils—because what they are saying just doesn't work here." His prophetic words stuck. Almost every year since I first heard George Kelly say Rocky Mountain horticulture is a maverick science, I have seen it proven in some way!

A case in point is my recent experience with crabapples. Our nursery is always looking for superior woody plants for the Front Range. About three years ago, we decided we should introduce some of the newer crabapple varieties that were purported to show resistance to fire blight, a bacterial disease that can seriously affect certain varieties of the tree.

One of the cultivars we selected to observe was 'Ormiston Roy', a pretty white-flowered tree with small persistent fruit. In the literature, it received the highest ratings for "disease resistance." I observed three 5-year-old specimens at the Crabapple Trial Garden at Colorado State University and all showed excellent form with no fire blight present in the plants. I discussed attributes of 'Ormiston Roy' with fellow plantsmen who had observed this tree in arboretums and gardens around the country. All looked good.

At least that's what we thought. But in our nursery this past summer, 'Ormiston Roy' exhibited what I would describe as a severe outbreak of fire blight: Major branches were infected

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with the bacterial disease. I revisited CSU's trial garden and found, of the three original plants, two had died and the remaining tree was severely infected with fire blight.

Well, great. This was the cultivar with all the high marks for disease resistance!

Perplexed by this development I was determined to find out more. I learned that the CSU trial, in which three replications of 50 varieties of crabapple were planted in 1985, is part of the National Crabapple Evaluation, a program of the International Ornamental Crabapple Society in cooperation with Morton Arboretum near Chicago. Trees growing on 23 sites throughout the United States are being evaluated for their resistance to such diseases as scab, cedar-apple rust, powdery mildew and fire blight, as well as their aesthetic value. Ratings from all the sites are tabulated and averages for the nation are published.

Here is the surprise: Morton Arboretum officials visiting the crabapple trial garden at CSU in summer of 1992 stated, "The incidence of fire blight is far greater and more severe here than on any other site in the nation." However, in checking the national ratings, I found that our unique Front Range environment presents very few problems with scab, cedar-apple rust or powdery mildew—something that cannot be said for other parts of the country.

Our major disease problem with crabapples is clearly fire blight. For example, 'Radiant' crabapple rates close to dead last on the national scale because of its susceptibility to scab, yet along the scab-free Front Range, it is probably the most widely-used crabapple and shows only a slight-to-moderate fire blight problem. National crabapple ratings appear to have little application to our region, and George Kelly's pronouncements about Rocky Mountain horticulture are ringing truer than ever.

I knew that Colorado was becoming notorious in national horticulture circles as the fire blight capital of the country. In light of our experiences at Fort Collins Nursery, I could only agree that our reputation was well-deserved.

Yet we still wanted to offer for sale flowering crabapples that would live for 20 years or longer without succumbing to fire blight and that would bear smaller fruit than the varieties we were currently growing. Toward that end we were willing to share what we had learned, for we had valuable information on several varieties we had grown over the years.

Recognizing that other Front Range growers probably had similar experiences, we invited 18 Colorado growers, along with Dr. Jim Klett, CSU professor and cooperator in the crabapple trials, to meet in September 1992 for an exchange of our experiences with the fire blight problem. Our time together proved very valuable.

One result of the symposium is the following list of crabapples to be *avoided.* These are cultivars which have shown severe to very severe susceptibility to fire blight (several major branches infected, considerable die-back or death of the tree).

Not recommended:

'American Beauty', 'Bechtel', 'Flame', 'Hopa', 'Mary Potter', 'Ormiston Roy', 'Pink Perfection', 'Professor Springer', 'Red Jade', 'Red Jewel', 'Red Splendor', 'Royalty', 'Sentinel', 'Silver Moon', 'Snowdrift', 'Strathmore', 'White Angel' and 'Zumi'.

Recommended:

Now, I would like to share a list of trees which showed none to moderate incidence of fire blight (numerous branch tips showing symptoms, few major branches infected). This list, while in no way complete, still might be worthy of consideration when selecting a crabapple that would exhibit low fire blight incidence when grown along the Front Range. Incidentally, it is my opinion that there does not exist a crabapple tree which offers complete fire blight resistance.

'Beverly'—Rounded and spreading form; small, light green leaves; pink buds open to single, white flowers; 5/8-inch red fruit.

'Bob White'—Dense rounded form; green foliage; pink buds open to single, white flowers; 1/2-inch persistent yellow fruit.

'Brandywine'—Vigorous growing; vase shaped; green leaves with a purple tinge (purple in fall); double rose-pink fragrant flowers; green fruits to 1 1/4 inches.

'Centurion'—Upright when young, becoming more rounded with maturity; reddish-purple leaves aging to green; red buds open to rose; 5/8-inch glossy red persistent (two to three months) fruits.

'Coralburst'—Compact, dense rounded form to only 10 to 15 feet; green foliage; coral pink buds open to rose; 1/2-inch red, persistent fruits.

'David'—Compact, rounded; green foliage (tends to conceal fruit); pink buds open to white; 3/8-inch to 1/2-inch red, persistent fruit.

'Dolgo'—Upright, spreading; glossy green foliage; large white flowers; 1 1/2-inch red edible fruits; the most cold hardy crab on this list.

'Indian Magic'—Rounded and spreading form; dark green foliage; rose-red buds opening to pink flowers; glossy red, 1/2-inch fruits changing to orange and persisting through the winter.

'Indian Summer'—Rounded form; bronze to green foliage; pink flowers; bright red, 5/8-inch persistent fruit.

'Prairifire'—Upright spreading becomng rounded; red to maroon foliage aging to reddish green; crimson buds open to pinkish red flowers; orange-red, 3/8-inch to 1/2-inch, persistent fruit.

'Profusion'—Upright spreading form; purple foliage fades to bronze; deep pink flowers; maroon, 1/2-inch fruits.

'Radiant'—Round spreading; reddish-purple foliage aging to green; deep red buds open to pink; bright red, 1/2-inch fruits ripen in summer.

'Red Baron'—Columnar form; reddish-purple foliage ages to a bronze green; dark red flowers; dark red, 1/2-inch fruits.

'Robinson'—Upright, spreading with age; reddish foliage ages to bronze green; pink flowers contrast well with foliage; 3/8-inch, dark red fruits are well hidden by foliage.

'Selkirk'—Rounded; reddish-green foliage ages to dark greenish bronze; deep pink flowers; very glossy red, 3/4-inch fruits.

'Spring Snow'—fruitless; white flowers; bright green foliage; upright, spreading; golden bark.

'Thunderchild'—Upright spreading form; purple foliage; pink to rose flowers; 1/2-inch, purplish-red fruits.

'Velvet Pillar'—Upright form with ascending branches; purple foliage; single, pink flowers; sparse, reddish fruits.

Generally, if you are planting crabapples, select a spot with good drainage, though the trees need irrigation. Fire blight, ironically, attacks vigorous, healthy trees, so avoid locations where the tree will receive a lot of fertilizer—for example, in the lawn.

Heavy pruning and truncating branches will only encourage vigorous interior growth (watersprouts) which are attractive to the disease. This factor is illustrated by an old variety of crabapple once grown here called 'Vanguard', a slow-growing semi-dwarf. Profit-conscious nurserymen stopped producing it because it took a whole year longer to grow to salable size, but it never got fire blight!

Considering the tremendous number of varieties available, you may wonder why there are only a handful for sale in local garden centers. Because assessments of crabapples in different parts of the country do not apply to Colorado, we must test each variety for ourselves. The nursery industry in Colorado comprises small independent businessmen; we love plants, but research and development budgets are limited.

We will learn much from Fort Collins. Eight years after the inauguration of the CSU trials, more than one-half of those varieties have developed disease problems. By consolidating all our information we have definitely made progress toward understanding diseases in crabapples.

Speaking as only one nurseryman, I will continue to look for superior woody plants to grow along the Front Range. With persistence, one may be a crabapple.

The Backyard Orchard

Robert Cox

If you enjoy the fruits of your labor, a backyard orchard may be just the project for you. Pride of ownership, therapeutic value, fresh fruit picked at the peak of ripeness and ornamental spring blossoms are good reasons for growing your own fruit trees.

However, fruit trees should only be planted by homeowners willing to work with them year-round: Pest control, pruning and other cultural and maintenance needs must be considered. Don't plant fruit trees to save grocery money.

Along the Front Range of the Rockies in Colorado, apples and pears ("pome fruits") and apricots, cherries, peaches and plums ("stone fruits") can be grown, some more easily than others. Our growing conditions and climate are not as conducive to tree fruit production as the Grand Junction area of the Western Slope. Your success with fruit trees in your yard will depend on good soil preparation, the location you choose for planting and careful selection of locally adapted varieties.

Fruit trees prefer full sun and well-drained soil. To plant a small orchard area, condition heavy clay soils by rototilling or spading in a 2-inch layer of coarse organic matter such as compost, sphagnum peat or aged manure (dairy cow, horse or sheep). The same procedure will improve texture, fertility and water-holding capability of sandy soils.

If you are planting just one or two trees rather than a small orchard area, you can improve soil conditions in the planting area by digging the planting hole at least twice as wide as the tree's root ball diameter, but a bit shallower than the tree's root ball depth. Mix organic materials into excavated soil at up to 25 percent by volume; then use this improved soil as back-fill.

Other than a small handful of superphosphate sprinkled in before back-filling, use no fertilizers in the planting hole. "Root stimulator" solutions, especially those promoting vitamin B1 as an "active ingredient," are of questionable value and are not needed. Organic mulches such as wood chips or straw applied after planting will help to keep soil moist and suppress weed growth.

Because freezing cold air is heavy and will flow into low-lying areas, avoid planting fruit trees in the lowest part or your yard; doing this would subject blossoms or small developing fruit to cold injury, reducing or eliminating the crop. Instead, if your yard allows, plant fruit trees on an east- or north-facing slope. Similarly, if trees are to be planted near the house, the east or north sides are best, as long as sunlight is plentiful during the growing season. Planting on south and west exposures would promote earlier-than-normal blooming, subjecting blossoms to a longer period of potential frost damage.

Late spring frosts when trees are in flower present the biggest obstacle to growing fruit in the Front Range. Our winters are generally scattered with several unseasonably warm days, which tend to encourage blooming before the danger of frost is past. For example, apricots tend to be the earliest-blooming fruit tree, well before the danger of frost is past. For this reason and the fact that winds and cold inhibit bee

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pollination of apricot flowers, Front Range apricots may bear fruit only one year in 10. However, apricot trees are very attractive, with lovely heart shaped leaves and gold fall color, and are worthy of planting even if fruit production is not dependable. Select later-blooming varieties such as SunGlo, Golden Amber or Chinese. Other good varieties are Sungold, Moongold, Moorpark and Goldcot.

The date and severity of late frosts will determine whether or not fruit will develop in your backyard orchard. Don't equate the term "hardy" in the description of the tree with "dependable fruit production." For example, the peach variety Reliance is "hardy" in that the tree and its flower buds can survive lower winter temperatures than most other peach varieties, but its flowers and developing fruits are just as susceptible to late spring frost as any other peach.

Besides selecting later-blooming varieties (especially important for apricots, pears, plums and peaches), some other tactics may help delay blooming by up to two weeks: Mulching trees 3 to 4 inches deep will keep the soil cooler than if it were bare, and cool soils delay flowering. Shading the south and west sides of the trunk with boards or other material may also help. Wrapping young trees' trunks with tree wrap in late October will accomplish the same thing and prevent winter damage called "sunscald" (Just remember to unwrap trees around April 1).

Trees planted on a north slope or north side of a building will bloom later than the same varieties with western or southern exposures. The home orchardist can also mist trees with water on warm days (above 50 degrees) in February, March and April to provide "evaporative cooling" for the blossom buds and, in turn, delay flowering.

If a fruit tree is in bloom when frost is expected, cover the tree with a sheet or cloth, if the tree is small. Some people report that small Christmas tree lights placed throughout the tree will give off just enough heat to protect flowers.

Just as important as delaying bloom and protecting against frost is choosing varieties whose fruit will mature before the threat of early frost in the fall. This is especially important for peaches and apples. For example, late season apples such as Arkansas Black, Rome Beauty or Winesap may not ripen fully in our area before cold weather threatens in late September or early October. Similarly, Belle of Georgia peaches would not be a good choice for our region.

For some homeowners, creating shade or privacy may be as important as producing fruit. If so, plant standard-size trees. For most city yards, with less space available, semi-dwarf and dwarf trees won't take up as much room. Also, they will begin to fruit at an earlier age and are easier to prune, spray and harvest. Dwarfed trees bear full-sized fruit, but are budded onto roots ("rootstock") which are not as vigorous. This limits the size the tree can attain. Miniature ("genetic dwarf") fruit trees can even be grown in large pots, attaining a full height of only 6 to 8 feet.

The pollination needs of fruit trees are often misunderstood. When a catalog description says that the tree needs a pollinator, it means that the tree won't fruit well unless there is another tree of a different variety within about 50 yards, blooming at the same time, so bees can readily transfer pollen from one tree's flowers to the other's. For example, Golden Delicious apple is a good pollinator for most other apple varieties: If your neighbor has a Golden Delicious and you have almost any other variety of apple within 50 yards, both trees should bear good crops. Exceptions include Red Delicious: Following a mild winter, it may bloom earlier than Golden Delicious, which would minimize pollen transfer. Also, Golden Delicious will not pollinate Jonagold apple. A solution would appear to be the "three-in-one" or "five-in-one" multiple-graft trees that have three or five different apple varieties grafted onto the same rootstock. Each grafted variety should become a major branch of the tree and the different varieties can serve as pollinators for each other. Locally, what usually happens to these multiple-graft trees is that one or more of the varieties are susceptible to fire blight, which may kill several of the branches (varieties). The result is a lopsided, one- or two-variety tree.

If a tree is "self-fruitful" or "self-pollinating" (most apricot, peach and sour cherry varieties are self-fruitful) it means that the tree can fruit well without another variety nearby. Most self-fruitful trees will, however, produce bigger crops if another variety is nearby. For example, Redhaven peach is self-fruitful, but another peach variety near it will help both varieties develop bigger crops.

Backyard orchard pest problems include peach crown borers, which attack stone fruit trees near the ground line; codling moths, whose larvae are found in "wormy" apples or pears; pear "slugs" which feed on leaves of pears, plums, peaches, apricots and cherries, and every gardener's nemesis, aphids, which are found in clusters primarily on leaves of plums, peaches and cherries. The apple maggot is an emerging pest problem. We have seen increased incidence of it in the past two years. Earlier-maturing apples with thin skins appear to be the most susceptible. One way to help control these and other garden pests is to plant a wide variety of flowering plants in your landscape. This diversity is attractive to beneficial insects who will help control the pest insects.

Diseases include fire blight, a bacterial disease that severely damages some varieties of pears, apples and crabapples. Many horticulturists feel that only apple and pear varieties considered resistant to fire blight should be planted in our area.

Fruit trees need only light fertilization with nutrients often lacking in Front Range soils. Zinc and iron may be deficient in soils that are too alkaline. Spring shoot growth of more than 12 inches may indicate excess nitrogen fertilization. Excess nitrogen stimulates excessive succulent shoot growth, which is very susceptible to fire blight in the case of apples and pears.

Fruit trees growing in lawns are often over-stimulated by lawn fertilizers. The pomes are then predisposed to fire blight. Stone fruit trees are often more susceptible to peach crown borer, which can more easily attack the lower trunk, as it is "softened" by the regular irrigation needed by the lawn. Lawn fertilizer in late summer or early fall can stimulate succulent new tree growth which will not "harden" (become sufficiently woody) before cold weather arrives, resulting in cold injury and die-back of new growth.

Ideally then, a fruit tree's root system should be mulched over rather than sodded over. Putting fruit trees in bed areas rather than lawn areas and using mulches not only eliminates tree-lawn competition for water, air and nutrients, it also prevents lawnmower and weed-eater damage to the trunk.

Do not fertilize woody plants, including fruit trees, after mid-July. Cut back on (but do not stop) watering trees in September to help alert the tree to harden off for winter. When tree leaves fall in late October or early November, water heavily to send trees into winter with a good moisture level. Water them during dry spells through winter.

Yes, it's a challenge here, but home-grown fruit for preserves, pies and eating fresh-off-the-tree is not beyond reach.

Local Best Bets

Choose these for hardiness, fire blight resistance, and bloom and harvest times. For more information, visit with your nurseryman and contact Colorado State University's Cooperative Extension office in your county.

- Apples: Wealthy, Duchess, Haralson, Golden Delicious, Red Delicious, McIntosh, Joyce, Northwest Greening, Lodi, Fameuse, Stayman's Prairie Spy.
- Apricots: Sunglo, Golden Amber, Chinese, Sungold, Moongold, Moorpark, Goldcot.
- Sweet cherries (not as dependable as sour cherries): Stella, Van, Black Tartarian, Kansas Sweet.
- Sour (pie) cherries: Montmorency, Meteor, North Star.
- Peaches: July Elberta, Reliance, any of the "Havens": RedHaven, HaleHaven, GloHaven, SunHaven.
- Plums: Santa Rosa, Burbank, Stanley, Blufre, Damson, Green Gage, Waneta, Sapalta

Green Trees Have Colorado Blues

James R. Feucht, Ph.D.

Growing trees in Colorado or, for that matter, anywhere in the Rocky Mountain West, offers many challenges: vagaries of climate, generally poor soil conditions and assorted pests. They make growing trees to mature size almost impossible, especially without a lot of effort.

Perhaps more of a challenge than pests is the condition of many soils, heavy clays with low oxygen content. In fact, many pest problems are aggravated by the poor soils, which weaken trees and, thus, make them more susceptible to attack by insects and invasion by disease organisms. In more than 25 years of field diagnosis while I was with the Colorado State Cooperative Extension, I found that up to 80 percent of the problems are seated in conditions of the soil.

A high percent of these problems are due to the compacted clays, which bring about "oxygen starvation" of roots. This one factor really separates Colorado horticulture from growing plants in the loamy, well-drained soils of some of the mid-Western and Eastern states. Real success here depends to a great extent on good soil preparation and on sensible site-specific management. With trees, of course, this is difficult because they soon outgrow the loamy mix we put in the hole—but shouldn't—as we plant them.

Adding vagaries of climate to our poor soil problem brings about even more frustration. Who has forgotten the deep freeze on Halloween 1991? Dead and mostly dead Siberian elms, some silver maples and introduced varieties of cottonwoods are still scattered across our cities. Why these trees? One would think, after all, that trees from Siberia should be able to take extreme cold. The silver maples had been around for many decades and, aren't cottonwoods natives?

The answer lies in the fact that all three are fast-growing types that tend to delay the normal hardening-off process in order to make late growth. In addition, none of them is truly native. What of the cottonwood (poplar) you say? The cottonwoods that were most severely damaged were hybrids, not the native plains cottonwoods (*Populus sargenti*) the narrowleaf cottonwoods (*P. angustifolia*) and lanceleaf cottonwoods (*P. acuminata*). In a sense, the hybrids didn't know how to get their antifreeze ready.

The most severe damage to silver maple (*Acer saccharinum*) occurred on trees already stressed by the alkaline condition of our soils, which leads to iron and manganese deficiency. Trees in this weakened state have little energy to divert to hardening-off, a process that requires a storehouse of sugars and starches.

So plants that go into fall and winter in either a vigorous condition or a weakened state become casualties of weather extremes. Frustrating, isn't it!

Trying to grow some of the more colorful flowering trees such as crabapples has its frustrations, too. Fire blight, a bacterial disease (*Erwinia amylovora*) that causes new growth—sometimes the entire tree—to blacken and die seems to attack most of the crab varieties that have the showiest flowers, such as 'Hopa', 'Bechtel' and 'Strathmore'. Fire blight is usually the most severe when we have the most favorable weather in the spring, cool and moist.

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It also attacks other members of the rose family, such as the mountain ashes.

Fortunately, Colorado's weather is not as conducive to other epidemic diseases commonly found in the mid-West and East. Treating large trees for foliage diseases is a rarity. An exception is Dutch elm disease, which is transmitted primarily by an insect, the elm bark beetle.

Insects and mites, however, can get the upper hand but, again, they are more severe when trees are weakened due to soil and climate. It has been shown time and again through research—and has also been my observation—that severe impact from heavy pest attacks can often be blamed more on poor tree health to begin with than on the pest themselves.

I have also observed that yards that are repeatedly sprayed for no reason other than "peace-of-mind" tend to have more severe problems with some insect and mite pests than those more-or-less left alone. Loss of the pests' natural enemies is likely a factor. For instance, I did a brief study several years ago of the tiny orange midge that causes stunted needles in pinion pines. The study was given further attention by entomologists at Colorado State University. It was observed that yards with pinions under regular, "contract" spraying generally had more stunt midge than those not sprayed. It turns out that a tiny black wasp (not the stinging kind) was an effective parasite of the midge. Spraying at the wrong time reduced the wasp population and multiplied the midges!

There are, of course, insect pests that do need occasional control. Aphids sometimes build up rapidly on birch, maple and many other trees. Chewing "worms" such as the larvae of elm leaf beetles, tussock moths on spruces and the more recent invasion from the south of ash sawflies (the larvae of a kind of wasp!) can do severe damage.

Even in these cases, though, timely, targeted sprays or the use of biological controls can prevent devastation of your trees. The real key to sound and timely control is in early detection of the pests, correct identification and good management of your trees.

For help, contact Denver Botanic Gardens or the Cooperative Extension office of Colorado State University in your county. Literature on the most serious diseases and insect pests is available free or at a nominal charge. The important thing is to monitor on a regular basis the health of your trees and take action when needed—before a pest problem grows out of control.

Some things to avoid:

- Do not assume that what a flagging tree needs is fertilizer. This is a common assumption, but can further injure a sick tree. If, for instance, the plant is weak from drought, lack of soil oxygen or excess salts in the soil, applying fertilizer will increase the stress on the tree. Also, research shows that excess nitrogen can actually lead to greater damage from pests such as aphids and mites.

- Do not water a tree unless you are certain that it is suffering from dry soil conditions. Wilting can be the result of excess water creating oxygen starvation, a natural gas leak, high soil salts or a vascular disease such as verticillium wilt or Dutch elm disease. Adding more water will likely magnify the problem.

- Do not assume that the presence of "bugs" on your trees will present a problem or call for immediate spraying. There are many "good guys" that may look like pests. For instance, the larvae of the ladybug are rather suspicious-looking orange and black "worms," but they are worth their weight in gold.

Another common insect that may appear to be a problem but is, in fact, very beneficial is the lacewing. This small-bodied, large-winged green insect devours many aphids and other soft-bodied pests.

- Avoid applying a "cover spray" over everything in your yard. This practice is guaranteed to lead to more problems and is dangerous to your health and to the health of pets, nesting birds and neighbors.

Growing trees to maturity in Colorado is a challenge and, now and then, may give us the "blues." But even the worst of conditions and the most serious pests are offset by the rewards of those trees that survive, grow, give us shade on hot days and protection on windy ones and most of all—inspire us with their beauty.

Tree Rings-Reading Between the Lines

Moras L. Shubert, Ph.D.

Who hasn't counted the rings on a tree stump or the end of a log to determine the age of the tree?

I believe all of us are aware that as a tree grows, a new layer or "ring" of wood is formed just under the bark each year. If a stump has 80 rings from its center to the bark, the tree must have lived for about 80 years. But did you know that, in addition to a tree's age, there is a wealth of information that tree rings can reveal?

As unique as a person's fingerprint, a tree's annual rings contain its whole life story. They are a permanent record of all the events that have taken place around the tree—from the climate and any catastrophic occurrences to which the tree was subjected to any interference by animals or humans. These events can be reconstructed by a close study of the rings' color, their form and width.

Initially, we observe that different colors of the wood create the rings. The light or dark tone of the ring expresses what time of year that particular layer of wood was being made. When the cambium produces new wood each year, larger cells are made during the cooler, moister springtime when growth is vigorous and the tree needs big vessels to carry a greater quantity of nutrients to its crown. As the season advances, becoming warmer and drier, the vascular cells being produced are smaller, as growth slows down. Therefore, each ring is lighter in color in the "springwood"and darker in color where cells are more compact in the "summerwood." This alternation of color, no matter how subtle, provides the visible new ring for each year. As one might expect, the color contrast may be less in tropical and subtropical climates where seasonal variations are milder.

Another message which can be deciphered from tree rings is the story of past climatic conditions, a possibility that first occurred to the insightful mind of Leonardo da Vinci. A tree's reaction to variations in its environment will be seen in its growth. The relative widths of a tree's rings indicate which years in its lifespan were the best for growth: if it was a moist warm year the ring will be wider than if it had been hot and dry. Technically, it is possible to count tree rings to determine the exact year, for example, of a drought. Using bristlecone pines (*Pinus aristata*) due to their sensitivity to rain, scientists have been able to reconstruct the climatic conditions from a period 7,100 years ago.

Other past events are recorded in a tree's annual rings as well. Their appearance can reflect the stress of a cold spell that occurred long ago. And harvesting a tree has sometimes uncovered a black scar within the tree's interior, indicating where and when this tree had been scorched by a forest fire.

Tree rings also provide a method for learning about past civilizations. Using an instrument called an increment borer, scientists can take core samples from trees or logs, and study the ring patterns along the narrow column of wood. This is how the cliff dwellings of the Anasazi Indians in such places as Mesa Verde have been dated back over 1,000 years, for these ancient dwellings were supported with log beams. Starting with a log or felled tree whose age is known, it is possible to cross-match its oldest rings with an older log from the same

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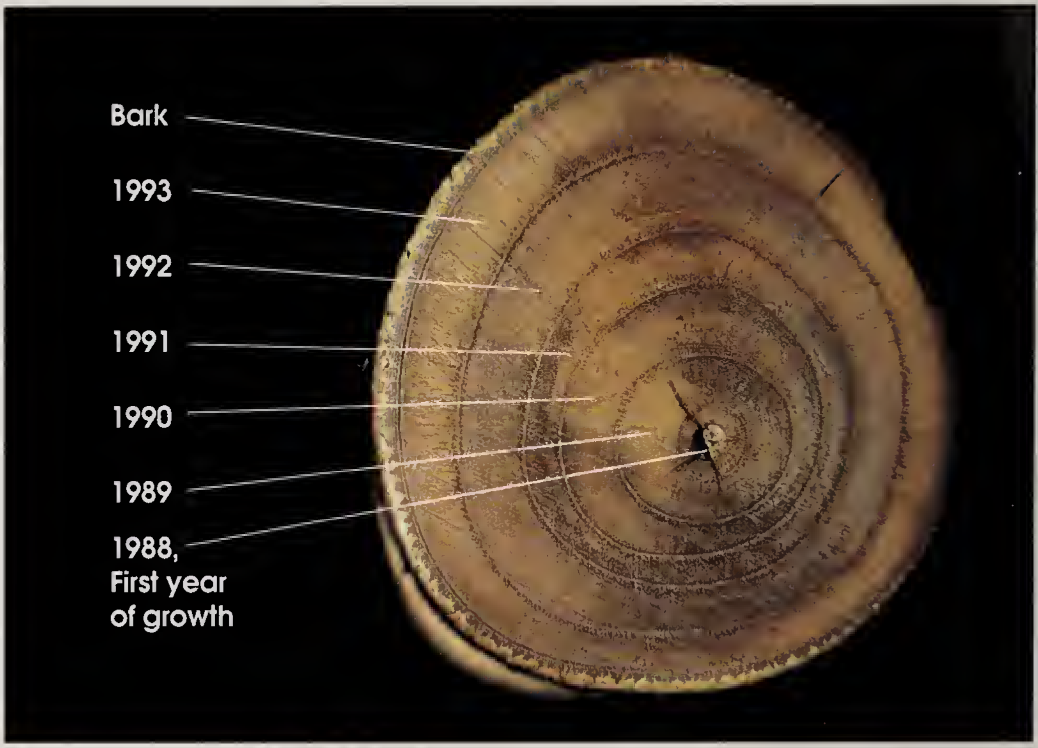

Below right: Native alder

Bottom right: Seed pods of golden rain tree

locale whose most recent (outer) growth rings are identical. This overlapping match-up process can be carried back through numerous "generations" of logs. In this way the construction beams of the Anasazi cliff dwellings were dated. It was comforting to the dendrochronologists (scientists who use this method for studying old wood) when carbon dating became available and verified the accuracy of their findings.

Besides telling us the ages of trees or logs, the zones of springwood and summerwood are responsible for the beautiful grain patterns in fine furniture, flooring, panelling and wood sculpture. What is a circular pattern of annual rings in cross-section becomes a variety of patterns depending on how the log is sawed. These patterns are more marked in some species, like pines and firs, than in others.

The production of veneers, very thin sheets of wood, has provided all kinds of elegant patterns for such items as table tops. Selected logs are cut into proper lengths called bolts, softened by steaming and then turned against a sharp blade, shaving off a thin layer like unrolling a roll of paper towels. This gives a grain that is somewhat parallel to the length of the log with the tree's variations in growth providing the amazing grain patterns. Indeed, when you consider what an elegant engraving tree rings are, a recorded natural history of what went on over a specific period of time in a given locale, you may never look at your hardwood floors the same way again.

How to Plant a Tree

Vicky Stinson

There is no simpler act of faith in the future than planting a tree. A tree is a legacy we leave to the generations who follow us—if we plant it right.

Among Colorado tree people, there are various opinions regarding the depth of planting, use of soil amendments, staking and removing root ball coverings, so some clear guidelines might be helpful.

But before we cover some of these specifics, you must make some initial decisions.

Begin by selecting the most appropriate location to plant your tree. If you're not already working from a plan, consider shade and solar benefits you might gain or lose from the placement of a deciduous tree. Consider the screening or winter wind protection to be derived from planting an evergreen tree. Be realistic about the ultimate size of your tree. Wherever possible, plant in bed areas rather than lawn areas as some trees have different water requirements from turf. Avoid planting in drainage areas. Also, know if you're planting a tree that is finicky about shade or sun. Select a variety suited to your purposes and site.

Ideal weather for planting is cool, cloudy and humid, but this cannot always be arranged. Early spring and early fall are the ideal times, but you can plant most any time providing the ground is not frozen or the tree is not putting on new growth.

Handling Your Tree

Once you have selected a location and are ready to plant, move your balled and burlapped (B&B) or container-grown tree near its intended place.

It is absolutely essential that the root ball not be broken up. Always handle your tree by its root ball, rather than its trunk. Depending on the size of your tree you may need a ball cart, dolly or wheelbarrow to transport it from your vehicle to the planting site. Once you have your tree near its destination, begin to dig the hole. Note: if weather is hot or you are planting several trees, dig the hole(s) prior to bringing the tree(s) to their planting location. Try to keep them in a shady location to prevent dessication.

Digging a Planting Pit

Start by measuring the diameter and depth of the root ball. Your planting pit should be at least two times the diameter of the root ball. The larger the diameter of your pit the easier it is to work around the ball once it is in the hole.

Usually, the pit depth should be about 2 inches shallower than the depth of the tree's root ball. If you happen to be planting in sandy soil, the pit should be equal in depth to the root ball, but never deeper. Take the time to measure as you dig, as it is almost impossible to compact the soil properly should you dig too deeply and need to replace soil in the hole. It is critical that the root ball sit on firm, undisturbed soil.

Do not add gravel to the bottom of the pit for "improved drainage," as this may actually hold water under the root ball and drown the roots. If you are planting in heavy clay soil, make an effort to roughen up the sides of your planting pit to assist root penetration beyond the pit walls.

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Planting Your Tree

If you are planting a tree grown in a plastic container, carefully remove the container by sliding it off the root ball, placing as little stress as possible on the trunk. If planting a B&B tree or tree grown in a fiber pot, carefully roll or rock the tree into the center of the planting pit. Without disturbing the root ball, cut off the top and sides of the fiber pot. Next, remove all twine from around the trunk and root ball of balled and burlapped trees and cut away at least the top half of the burlap. If the root ball is in a wire basket, cut off at least the top two-thirds of the basket. Twine left in place will girdle and eventually kill the tree. Remove all excess material from the pit. The tree's root ball should be about 2 inches higher than the original surrounding ground level, even higher for some species such as birch, mountain ash and cherry.

Begin filling the pit with the soil that was removed, keeping the tree plumb. To support the tree you may want to add about one-third of the backfill prior to removing the burlap and twine from B&B trees.

Though some experts recommend adding amendments to the soil, I do not. It is possible that adding organic amendments to the soil retards growth, as the roots will tend to stay within their amended planting pit much as they would in a pot.

Water with a hose as you backfill, to settle the soil and eliminate air voids. Do not tamp the soil. Add more backfill if settling occurs over the next day or so. Build a temporary saucer or rim of soil around the outside of the pit if your tree is within a bed area or an unirrigated area.

Mulch with several inches of wood chips, especially if you are planting in the fall. If your tree is in a lawn area, remove a two-foot circle of sod from around the tree and mulch, to prevent mower or weed-eater damage to the trunk.

Staking Trees

For deciduous trees in very windy areas or when the root ball is disproportionately small compared to the size of the tree's crown, staking is necessary. But don't use staking to straighten a crooked tree!

If you need to stake your newly planted tree, use two steel t-bars or two 2-inch x 6-foot wooden stakes. Drive them into undisturbed soil, with one stake on the northwest side of the tree. Connect stakes to the tree with horizontal guy wires fastened to the tree with soft carpet strips or nylon tree straps, but not so tightly as to prevent some movement of the trunk. Never place the wire itself around the tree! Attach a small colored flag or white pvc piping to the wires so people don't trip over them. Finally, after a year, remove all staking and straps to prevent girdling the tree.

Tree Wrap

An important word about wrapping tree trunks: wrapping is only a temporary, November-to-April, protective measure against sunscald, which occurs in our area on certain species only in late winter and early spring. Tree wrap may be used for the first winter or two after planting to prevent sunscald on thin-barked newly transplanted trees such as maple, linden, Japanese pagoda and honeylocust, and should not remain on trees through the spring and summer. So often we see trees that have been in the ground for many years bursting out of their dilapidated tree wrap, looking pathetic and neglected.

Wrap young tree trunks in November, starting from the base, and secure the wrap with a couple of tacks. Never use tape or twine for this purpose. Then be sure to remove it around April 1 by unwinding the wrap, which, if left on, could harbor opportunistic insects or diseases. Furthermore, never accept a new tree that is already wrapped without first removing the wrap to inspect the trunk; it could be cracked or otherwise damaged.

By applying sound tree-planting practices, you will help ensure the health and long life of your trees—so that they may be appreciated by future generations.

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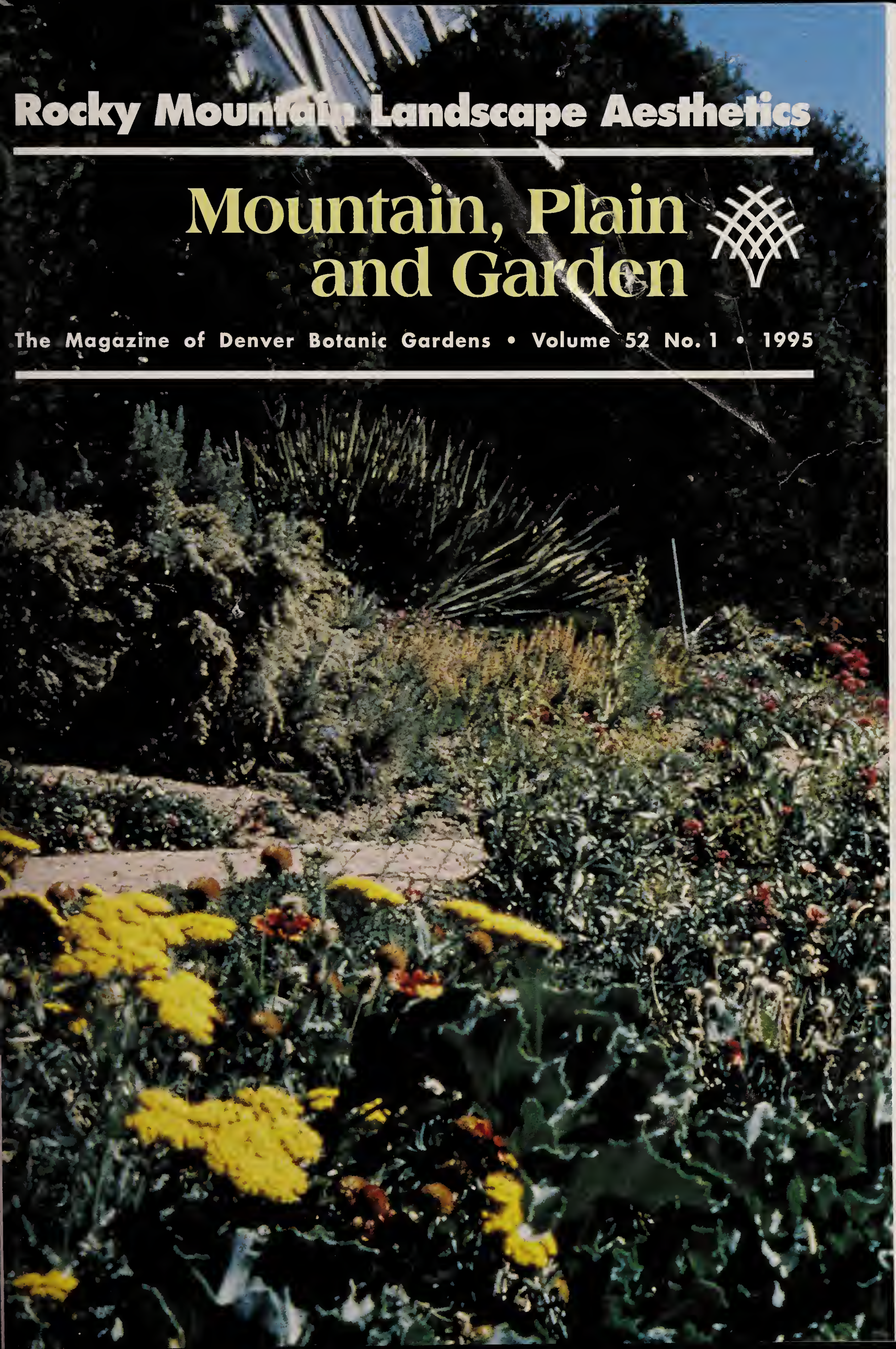

Mountain, Plain and Garden

The Magazine of Denver Botanic Gardens
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Waterwise Gardening, Water-Smart Gardening™, Xeriscape Gardening:

Toward Appealing Rocky Mountain Aesthetics

Jim Knopf

Low-water landscaping, less-water landscaping, water-efficient landscaping—the superabundance of terms gets in the way. But whatever it's called, gardening in pursuit of water conservation, especially when combined with the pursuit of appealing local landscape aesthetics, is wonderful. It's fun. It's pretty. It saves water. It solves environmental problems. It's all good news.

There are many wonderful styles to pursue—ranging from landscapes that appear as if they were never disturbed, to landscapes that use native plants in formal fashion, and to landscapes that use wonderful well-adapted introduced plants. There is room to accommodate many personal preferences and to address any landscape situation.

With so many wonderful natural landscapes for inspiration, and so many possibilities for appealing adaptations to the full range of modern urban landscape situations, it is surprising and tragic how far most landscaping has strayed from sensible, satisfying designs. It is also tragic how fast the scenic and meaningful natural landscapes of the vast and varied Rocky Mountain region are disappearing in the current frenzy of urbanization.

Before it is too late, it is worth reflecting on some of the evocative natural landscapes that could lead us to more satisfying and sensible urban landscape surroundings. Piñon-Juniper, and Ponderosa-Oak woodlands, Blue Grama-Buffalograss prairie, and Aspen-Engelmann Spruce-Subalpine Fir forests are among the major image-setting natural landscapes to study. Each of these natural landscapes is composed of numerous larger and smaller plants arranged in meaningful, marvelous patterns. Each landscape type also presents specific visual and horticultural challenges to urban translation.

This issue of *Mountain, Plain and Garden* is devoted to the challenging and alluring, but elusive goal of expressing these marvelous natural landscapes of the Rocky Mountain region in meaningful modern landscaping.

The terms Water-Smart Gardening™, Xeriscape, xeriscape plant, drought-tolerant plant and aesthetic are worth some special attention, since they are often used to mean different things.

Water-Smart Gardening™ (a term used by Denver Botanic Gardens) and **Xeriscape** (a term first promoted by the Denver Water Department) have always been intended to refer not only to landscaping that is entirely dry, but also to landscaping that uses some water wisely. Entirely dry landscaping is clearly consistent with the goal, but so are heavily-irrigated athletic fields, because they grow faster and repair themselves faster than non-irrigated athletic fields. Water-efficiency and wise use of water are the goals. Also, neither term is intended to refer only to rock and gravel landscaping, though rocks and gravel can be quite attractive. Likewise, neither term refers only to native plant landscaping, though native plants are often part of good waterwise landscaping.

Jim Knopf, landscape architect and author of *The Xeriscape Flower Gardener,* lives and gardens with lots of native plants and wild critters in Boulder, Colorado.

Xeriscape plant: Technically, *this is a meaningless term,* since waterwise landscapes can have highly- and moderately-irrigated, as well as non-irrigated areas. When referring to plants that need little or no irrigation, it is better to use the terms "xeric plant" (xeric = dry) or "totally drought-tolerant plant."

Drought-tolerant plant: This term is used in several very different ways. First, it can refer to plants that never need irrigation. Second, it can refer to plants that simply need little irrigation. Third, whether a plant needs a lot or only a little irrigation depends on the local climate. For example, Black-eyed Susan (*Rudbeckia hirta*) needs no irrigation in Atlanta, Georgia, but needs regular irrigation in Albuquerque, New Mexico.

Aesthetic: "Pertaining to the beautiful, as distinguished from the moral" . . . "Appreciative of, or responsive to, the beauty in art or nature" . . . "Expressing good taste" . . .

Dictionary definitions of this evocative word suggest that the pursuit of a Rocky Mountain landscape aesthetic is the pursuit of enticing, artistic and meaningful Rocky Mountain images. It is on these notions of enticing and meaningful landscapes that this issue of *Mountain, Plain and Garden* focuses special attention.

Facing page, left column: *Aspen-Spruce-Fir forests*—some of the early architecture fits well, some of the newer architecture does not.

Facing page, right column: *Piñon-Juniper woodlands*—these visually attractive landscapes are easy to restore and maintain. Why cover them with gravel?

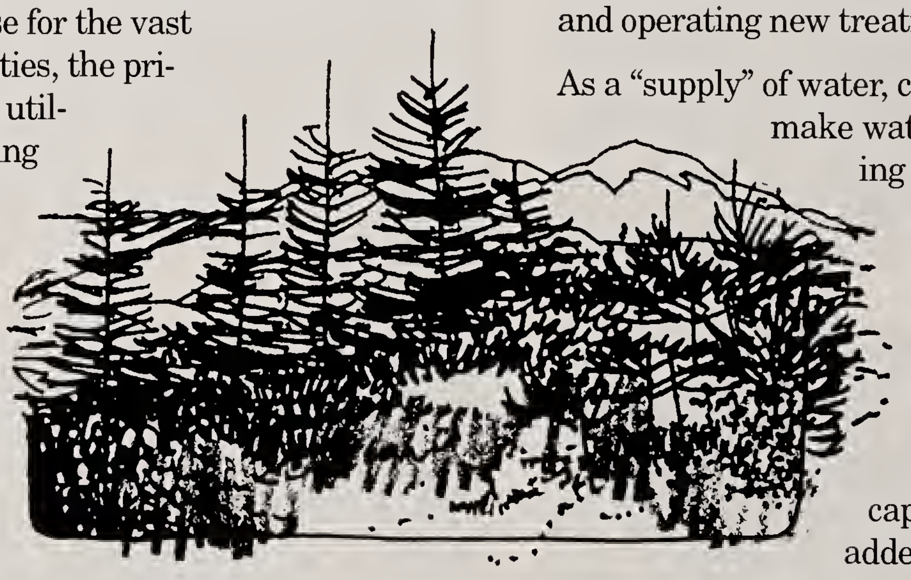
This page: *Blue Grama-Buffalograss prairie*—these native shortgrass landscapes offer many attractive variations for urban settings. Who really thinks gravel is nicer?

The Cost of Treating Drinking Water

Paul Lander

Most utilities in the western U.S. treat water to drinking-water standards only to have 50percent or more used for landscape irrigation. To make things worse, the demand for landscape water occurs during a four to five-month summer period, creating a surge in demand which is often three to four times the demand for water in the winter.

If a community had a dual-pipe distribution system, it would be easy to satisfy the landscaping demands utilizing untreated (raw) water directly from surface or groundwater sources. But, with only a single-pipe distribution system, which is the case for the vast majority of utilities, the primary option for utilities in addressing this problem is to reduce overall summer water demand, and especially the summer peak demand.



It costs money to treat water to drinking-water standards. It costs a *lot* of money to build and expand a treatment system's capacity to keep up with the growing peak demand. Peak demand drives the ultimate size, operating cost, and the rates most utilities charge customers. Here in the semi-arid West, it is our decades-old habit of importing and growing water-loving plants that has created that peak demand.

A portion of the operating costs of any utility is fixed—to pay personnel, to maintain equipment, and so on. As more water is treated, more money is spent by utilities, so conserving water helps keep facilities operating at their most efficient levels. Water conservation is a superior, and money-saving, alternative both to finding and developing new water supplies, and to building and operating new treatment facilities.

As a "supply" of water, conservation can usually make water available to an existing system at one-half to one-third the cost of buying new water. On the treatment side, conservation can save money by extending the time before new treatment facilities—increased capacities—need to be added. Adding time can add up to big savings.

In 1988, the Delaware River Basin Commission estimated that capital costs alone (this does *not* include the cost of financing) for water-supply facilities were about two million dollars per million gallons per day (MGD) of capacity, and about four million dollars per MGD units, which adds up to big money very quickly. So, save some water, and save your town money for other (possibly more important) needs of the community.

Paul Lander, water conservation specialist for the City of Boulder, Colorado, keeps Boulder residents on their waterwise toes by organizing an array of services, ranging from waterwise programs to xeriscape design contests. He is current chair of Metro Water Conservation, Inc.

The Hard Lessons of Rocky Mountain Droughts

Jim Knopf

If nice weather is sunny, dry and warm, then drought must be wonderful . . . not so! The early pioneers on the High Plains and in the Rocky Mountain West, who tried to farm as if they were still in the East, learned very hard lessons about the frequency and severity of droughts in this region. Likewise, today's suburban gardeners will also have to learn the hard way that drought here is both common and very disruptive, if they continue to pretend that water for irrigation is unlimited and cheap.

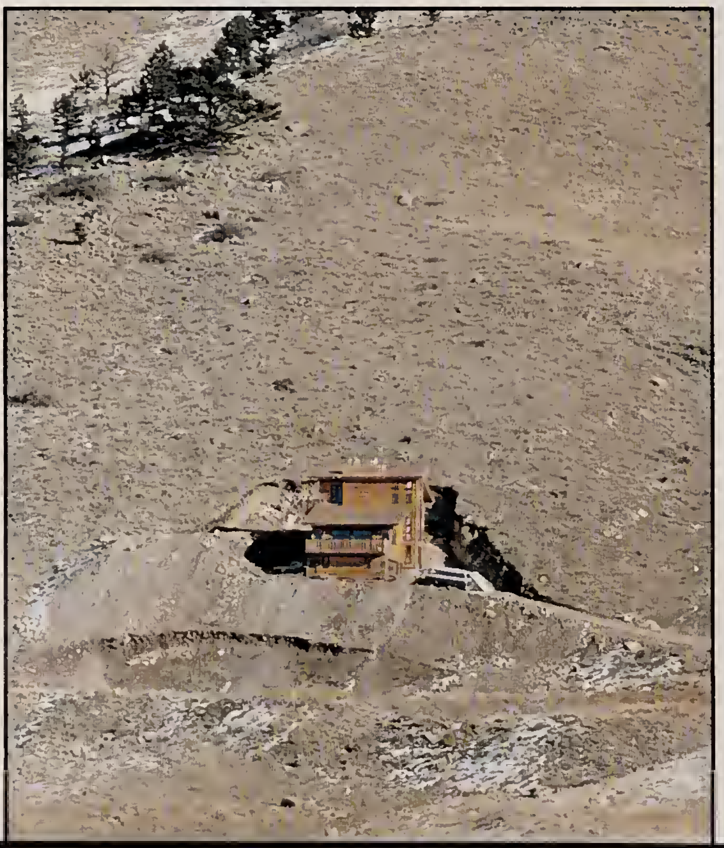
The evidence is clear. The 20- to 22-year recurrence of droughts in the Great Plains of North America is well documented. 1892, 1912, 1934, 1953,1976 and (1998?) mark mid-points of droughts in this pattern. Intriguingly, this coincides closely with the timing of every other sunspot minimum, when the magnetic polarity of the leading sunspots in the sun's northern hemisphere changes from north-seeking to south-seeking. Making this pattern even more compelling, tree-ring studies indicate that during the 1600's there was a 70-year drought in the western U.S. occuring at the same time sunspots were essentially absent for 70 years. By comparison, the "Great Drought" of the 1930's lasted only about 6 to 9 years.

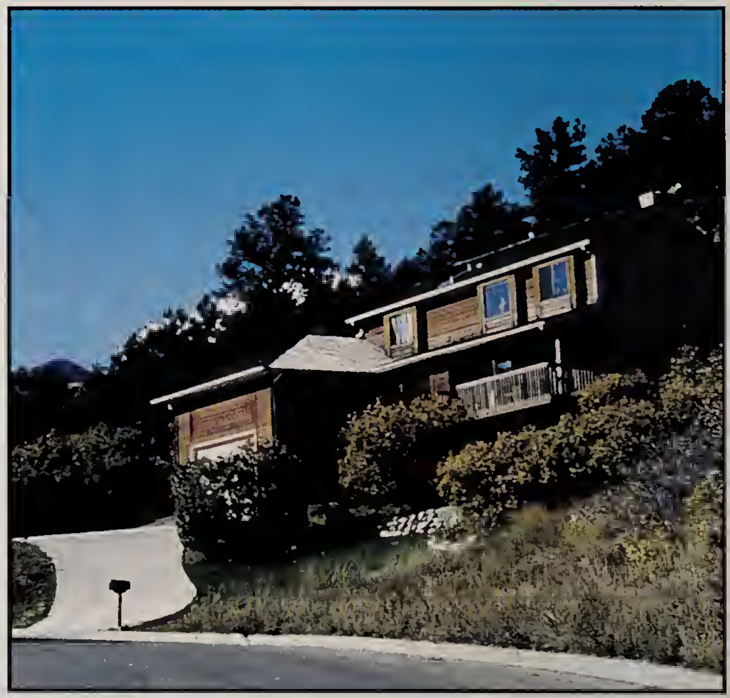
Taking a longer view, vast variation in wet and dry periods are indicated by geologic studies covering approximately the 10,000 years of current climatic conditions since the last great Ice Age. All of this might lead people to wonder about the severity of a "1,000 year drought." Consider California. Beginning about 1,100 years ago, the Golden State has endured two mega-droughts. The first lasted 220 years and the second lasted 140 years. These droughts were not only much longer, they were also much drier than the modest "dry spells" of the 20th Century.

The message should be clear . . . live realistically within the limits of local water supplies or suffer the consequences. Fortunately, these climatic conditions have resulted in some of the most appealing natural landscapes anywhere, and these wonderful natural landscapes are well suited to urban and suburban surroundings.

This page: *Ponderosa Pine-Gambel's Oak woodlands*—buildings often look best in these open woodlands, with their knee-high grasses, when the site is disturbed very little.

Bottom left and right: Regrading of hillsides should be avoided or done very carefully. Poorly graded hillsides often never recover, while undisturbed hillsides are often very attractive.





Fawn Hayes Bell, designer of the beautiful Colorado Springs Xeriscape Demonstration Garden (a marvelous companion to nearby Garden of the Gods) is a professional landscape architect in Colorado Springs, Colorado.

The Role of Landscape Design Guidelines:

Two Examples from Colorado Springs, Colorado

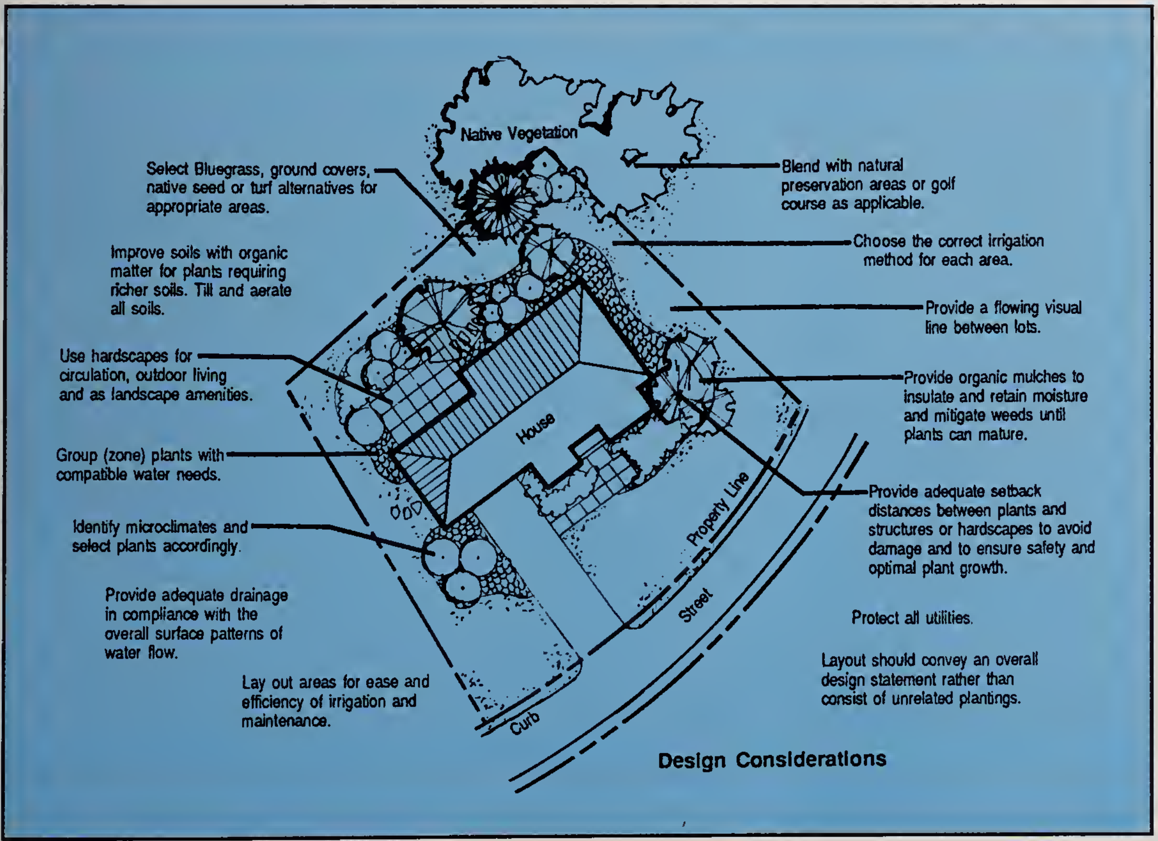
Fawn Hayes Bell

Example #1: "Colorado Springs Landscape & Site Improvements Design Guidelines"

In 1993 the Colorado Springs Water Resources Department asked me to prepare design guidelines to facilitate eventual landscape development of some thirty-five sites. The Water Resources Department has a strong commitment to promote water-efficient landscapes, and has conducted an active program, including the construction of an award-winning Xeriscape Demonstration Garden, a community-wide ET program, and numerous research and educational programs.

Despite the success of these programs, there was one question frequently posed by the xeriscape garden visitors which was difficult to answer: "Where can I see examples of water-efficient landscapes?" From these inquiries the direction for a new project was developed—to landscape the department's own sites throughout the community to illustrate xeriscape design principles and to create a portfolio of examples for interested customers.

Initially, the task of writing the guidelines focused on (1) implementation and management of the proposed landscape improvements, (2) communicating the Department's role in water conservation, (3) the creation of sustainable landscapes, and (4) the preservation of indigenous and endangered species. For example, at the historic 33rd Street Pump Station, the site will be renovated to reflect the historic character and the urban riparian setting. At tank sites located throughout the community, from clay foothills to sandy plains, the natural setting and plant communities provide distinctly different design directions. As the project progressed, the guidelines' purpose was enlarged to foster local community awareness of landscape design


Native Vegetation
Select Bluegrass, ground covers, native seed or turf alternatives for appropriate areas.
Improve soils with organic matter for plants requiring richer soils. Till and aerate all soils.
Use hardscapes for circulation, outdoor living and as landscape amenities.
Group (zone) plants with compatible water needs.
Identify microclimates and select plants accordingly.
Provide adequate drainage in compliance with the overall surface patterns of water flow.
Lay out areas for ease and efficiency of irrigation and maintenance.
House
Curb
Street
Property Line
Blend with natural preservation areas or golf course as applicable.
Choose the correct irrigation method for each area.
Provide a flowing visual line between lots.
Provide organic mulches to insulate and retain moisture and mitigate weeds until plants can mature.
Provide adequate setback distances between plants and structures or hardscapes to avoid damage and to ensure safety and optimal plant growth.
Protect all utilities.
Layout should convey an overall design statement rather than consist of unrelated plantings.

Design Considerations

issues and to encourage similar efforts from others, like universities, developers and public agencies, whose actions affect the land. The guidelines became an opportunity to challenge the community's ability to create landscapes that convey a sense of regional context and reflect man's commitment to shape a positive, sustainable future.

Unlike regulatory ordinances, guidelines serve to show how to achieve a goal, instead of emphasizing regulatory constraints and/or requirements. Because they are not regulatory, one of the problems for landscape guidelines is —"How do you get people to read them?" It helps to assume that people are looking for solutions, and to start with a clear mission statement. It is also important to define the audience—will the document be used by technical or lay readers? Is it part of a larger effort—or a stand-alone piece? Finally, define "success"—is it related to large-scale distribution, education, compliance or to stimulating new ideas?

The Colorado Springs Water Resources Department *Landscape and Site Improvements Design Guidelines* were published in September 1994. They were the result of a collaborative process including this consultant, the client and an enthusiastic and supportive group of volunteers. They will be considered a success if they gain acceptance by the community, are used by members of the target audience, result in an improvement and beautification of the community, increase water conservation, and if they enhance active partnerships between the Water Resources Department and the community. The guidelines received 1994 awards from the American Society of Landscape Architects, Colorado Chapter, in the categories of "Research and Communication," and "Outstanding Public Entity."

The following excerpts from the guidelines, with photographic illustrations, show two examples of ideas which the guidelines are intended to accomplish.

Identifying an appropriate landscape character:

Designers are encouraged to develop innovative and regionally-specific design solutions which will serve as examples to . . . school districts, developers, public agencies and commercial institutions. One of the first design tasks for a particular site is to identify which image of the Colorado Springs regional landscapes it should reflect. Is it the short grass prairie which bounds the city on the east, or the Piñon-Juniper plant community on the southern edge, or the foothills scrub oak and ponderosa pine? Is it perhaps the cultivated and groomed mix of indigenous species and adapted exotics introduced over more than a century of habitation by the many people who have adopted Colorado Springs as their home?

Slopes, Grading and Berms:

Where possible, retaining existing vegetation will assist with control of erosion by water and wind . . . A slope contoured to look natural will visually blend with the native terrain . . . Where berms are used as a buffer, to screen views and divert sound or for visual interest, it is important that large, gently rolling landforms compatible with the landscape be created . . . A rigid berm of constant slope and height is not typically harmonious with the surrounding natural landforms . . . A convex slope (at the bottom) is preferred . . . avoid berms fewer than 10 feet in width.

Example #2:
Kissing Camels Estates Landscape Guidelines

The landscape and site improvements design guidelines have served as a catalyst for other guidelines which are more detailed and project specific. For this residential development, these brief guidelines stimulate a more thorough approach to design, as in the following excerpt :

> "One of the key design considerations is whether to overlay the natural setting with an alternate landscape style from another region of the country, or to reveal the setting by using compatible colors, native plant materials and patterns of planting which echo the natural plant communities."

In our modern urban settings, filled with constraints, intensity and great expectations, we long for inspiration, beauty, and a sense of regional identity. Landscape guidelines, when structured properly, can fill these needs.

Beyond Ecstasy in a Can

Three Native Meadows for Modern Landscaping

Jim Knopf

Mention meadows in landscaping, and thoughts quickly turn to images of the unbelievable meadows on pretty seed packages. Unfortunately, meadow mix marketing, with overly-pretty pictures of flowers, grasses and beautiful butterflies, threatens to take meadows out of reality and into some other realm. In fact, it is probably only a matter of time before "Ecstasy in a Can" meadow mix hits the garden market. The advertisements might read:

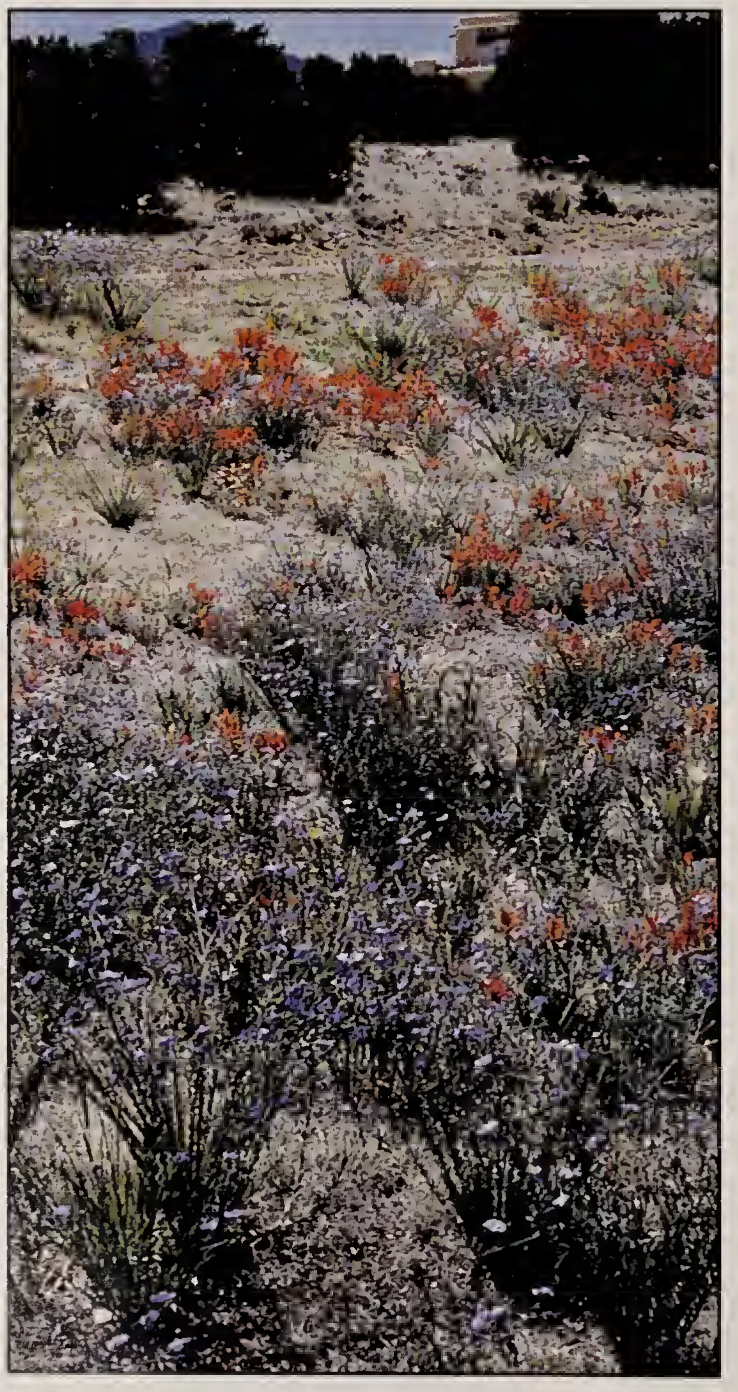
> Just scatter in the wind, and enjoy ecstasy beyond your wildest dreams . . . completely legal . . . only slightly addictive . . . basically harmless . . . thousands of ecstatic customers.

Unfortunately, this "euphoric" approach to meadows is usually disappointing and misses the real value that meadows offer in addressing modern landscape needs. Suburban open space areas, highway right-of-ways, and wildlife gardens could all benefit from landscaping that is both much more realistic than most commercial meadow mixes, and less costly to maintain than traditional, manicured lawns.

For modern landscaping, a meadow could be defined simply as a visually-appealing mixture of flowers and grasses. With this definition, the tallgrass, midgrass, and shortgrass meadows native to the Rocky Mountain Region and Great Plains, are worth serious consideration for landscaping on sites where each is adapted. It is important to note that the height of a meadow is largely determined by the species of grasses that are selected, and the height of a meadow is important for the visual impact as well as the uses of the meadow area. It is easier, for example, to walk around on a shortgrass meadow than on a mid or tallgrass meadow, and it is easier to see across a short or midgrass meadow than a tallgrass meadow.

Shortgrass meadows tend to grow less than ankle high and are the dominant grassland of the western high plains, where the Rocky Mountain rainshadow results in the driest conditions on the Great Plains. The dominant grasses are buffalograss (*Buchloë dactyloides*) and blue grama (*Bouteloua gracilis*). Some of the associated wildflowers are chocolate flower (*Berlandiera lyrata*), blanket flower (*Gaillardia aristata*), and mexican hat coneflower (*Ratibida columnifera*). Buffalograss is such a vigorous, spreading grass that it can crowd out many wildflower species. Greatest success with wildflowers in this grassland type may come from planting the wildflowers in areas where only blue grama is planted, because blue grama is a bunchgrass and won't crowd out wildflowers. Alternatively, the entire meadow area might be planted using only blue grama. It should also be noted that this grassland type is best grown on very warm, dry sites. In Colorado, meadows at elevations above about 6,000 feet are usually too cool and moist to remain entirely blue grama and buffalograss, and tend to evolve toward midgrass meadows. A good example of a shortgrass meadow can be seen at the Denver Botanic Gardens. Another extremely photogenic shortgrass meadow can be seen around the Old Pecos Office Compound on Old Pecos Trail in Santa Fe, New Mexico. In this meadow planting, blue grama, Paintbrush (*Castilleja sp.*) and blue flax (*Linum perenne*) were seeded under the native piñon pines, and have resulted in a stunningly attractive, low-maintenance setting for the Santa Fe adobe-style buildings.

Midgrass meadows tend to grow from knee high to waist high and are common among ponderosa pines. Boulder, Colorado, for example, has many areas of this grassland type extending from the mountain backdrop into residential areas. In many cases these areas have been stable and attractive for 20 to 30 years with little or no maintenance. Dominant grass species are western wheatgrass (*Agropyron smithii*), little bluestem (*Andropogon scoparius, syn. Schizachyrium s.*), and sideoats grama (*Bouteloua curtipendula*). Purple prairie clover (*Dalea purpurea*), pitcher sage (a.k.a. blue sage) (*Salvia azurea*) and Lewis' flax (a.k.a. prairie flax) (*Linum perenne var. lewisii*) are three wildflowers that grow well in these grasses. During dry conditions, where fire danger is a concern, mowing or grazing "defensible" space adjacent to buildings creates very effective fire breaks.



Narrow, watered lawn areas are also effective. The greatest fire danger is actually from ponderosa pines, junipers and piñon pines that may grow in this grassland type. The grasses contain little fuel, but can carry a fire to the trees and shrubs. Removing lower limbs on ponderosa pines, and maintaining a reasonable distance between buildings and the woody plants is an important consideration. Taking these precautions will usually result in fire danger no greater than in the same type of forest areas that have watered lawns.

Tallgrass meadows were the dominant grassland in the eastern Great Plains before farming and ranching changed everything. Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), and switch grass (*Panicum virgatum*) are the dominant grasses. Wildflowers include purple coneflower (*Echinacea purpurea*), wild monarda (a.k.a. wild bergamot) (*Monarda fistulosa*), and Maximilian's sunflower (*Helianthus maximilianii*). These grasses and flowers are adapted to relatively moist conditions, compared with short- and mid-grass meadows.

Maintenance of tallgrass areas, because they are wetter than mid- and shortgrass meadows, is likely to require periodic mowing and/or burning to keep woody shrubs and trees from dominating. Midgrass areas, by contrast, often continue indefinitely without mowing or burning. It depends on the site, however. Excessive moisture is the major factor in favoring woody plant growth. Shortgrass areas may need occasional mowing to keep cool season grasses from growing too tall during cool, wet periods.

A bit of pioneering spirit and a bit of perseverance is very helpful, since meadow landscaping has been worked with so much less than has traditional "lawnscaping". Also, meadows are dynamic, and change a lot, especially in the first few years. Real economic and aesthetic rewards, however, await those who pursue the challenge of finding more sustainable and satisfying types of landscaping.

This page: Restored shortgrass meadow with paintbrush, blue flax, blue grama, and buffalograss.
Opposite left: Turf-type tall fescue.
Opposite right: '609' buffalograss.

New Turf-Types of Buffalograss and Tall Fescue

Jim Knopf

Buffalograss

Buffalograss, a native warm-season grass from the western Great Plains, shows extraordinary promise for widespread use as a lawn grass in hot, sunny dry, locations. Being a warm-season grass, it tends to start spring growth about a month later than turf-type tall fescue or Kentucky bluegrass, and goes dormant about a month earlier in the fall. However, some of the new varieties are day-length neutral, and retain their color a month longer in the fall. Other new varieties begin spring growth several weeks earlier in the spring. It remains to be seen whether the season can be extended in both spring and fall. The color of most varieties is a beautiful greenish-blue, but some of the new kinds are an appealing blue-green. Male forms of buffalograss have attractive flowers that stand a little above the 4-6 inch high leaves. Female forms do not have flowers that are visible from a distance. Commercial plant selection is taking advantage of this by providing all-female or mixed male and female varieties.

Because it is so low-growing, buffalograss does not require mowing, but mowing about once a month easily maintains a more traditional lawn appearance. The water and fertilizer requirements are extremely low. Watering about once per month in the hottest weather is all that is needed to maintain the beautiful blue-green color. Except in the driest desert areas, it needs no irrigation to survive quite well, and this is creating enormous interest in places where irrigation is not possible. The new female varieties are available only as sod or plugs, in order to maintain the all-female type plants. Mixed female-male varieties are already available for seeding lawns and short grass meadows.

Buffalograss is generally not satisfactory in shade, though some of the new varieties will do well in light shade. Buffalograss thrives in hot weather. 90° F, or more during the day, with very warm nights is when it grows best. Buffalograss is the "hot" new choice for lawns in hot, dry, sunny places across much of the western and south-central U.S.

Finally, there is even sexual instability in buffalograss. Where growing conditions vary enormously from year to year, some plants have evolved to make the most of their precarious situation by performing the female sex role of producing seeds when conditions are favorable. Then, when conditions are less favorable, they switch to the male sex role of producing pollen. Apparently it requires less favorable conditions to produce pollen than to produce fully developed seeds. In this way, there is more pollen in tough times so that some of it can reach the few female plants that may be located in favorable, but remote locations. Buffalograss, saltbush (*Atriplex spp.*), and Jack-in-the-pulpit are examples of this intriguing adaptive strategy. In the buffalograss turfgrass industry, a sexually stable, female-only form of Buffalograss is considered so commercially important that a bumper sticker slogan has even been proposed. The proposed slogan—"it's 9 p.m. Do you know what your brand of buffalograss is doing?"

Tall fescue

Turf-type tall fescue is a cool-season grass, like the familiar Kentucky bluegrass. It has essentially the same dark green color, but it is much more shade tolerant. It is also more tolerant of road salt and irrigation water with high salt content. It competes with tree roots far better than Kentucky bluegrass, and it is doing very well in the heat of southwestern desert areas where Kentucky bluegrass won't survive, even with unlimited irrigation. There appear to be no insect problems. The biggest difference, however, may be how much less nitrogen it needs. Grown with clover, it might never need fertilizing, on many soils. In general, turf-type tall fescue grows in a wider range of conditions than Kentucky bluegrass. It appears able to use more water, when it is available, but maintains a completely satisfactory appearance with much less water—savings of 30 percent to 50 percent not uncommon. In fact, turf-type fescue has been compared with a light on a dimmer type switch, where growth can be turned up with more water and more nitrogen, or turned down with less water and nitrogen. Faster growth is frequently desirable on athletic fields following major events, but it is often not desirable on a home lawn. Kentucky bluegrass, by contrast, is more like a light on an ordinary switch. It either grows full tilt, or it goes dormant. In many dry western areas, Kentucky bluegrass will go brown in as little as one day, while adjacent turf-type tall fescue will gradually go less and less green over 3 to 5 days, or even more. Turf-type tall fescue is a bunch grass—meaning it does not spread as Kentucky bluegrass does. This means it does not invade adjacent gardens—no need for sharp metal edging. Turf-type tall fescue is available as sod, or a lawn can be grown very successfully from seed sown on site. It is also easy to top-dress and overseed an existing fescue lawn that needs some renovation.

Water-Smart Gardening™ at Denver Botanic Gardens:

The Laura Smith Porter Plains Garden

This unique recreation of several native grasslands was thoroughly written up in *Mountain, Plain & Garden*, Spring/Summer 1987.

The shortgrass prairie of the Plains Garden shows special promise for addressing urban landscape needs.

Water-Smart Gardening™ at Denver Botanic Gardens:

The Water-Smart Garden

Lauren Springer

This sunny, south-facing bed showcases over three hundred species and cultivars of plants—shrubs, perennials, groundcovers, annuals, biennials, succulents, herbs and bulbs—that all thrive on little water. Some are well-known favorites such as basket-of-gold, dianthus, lavender, baby's breath, blue flax and thyme. A large number of native plants are included, with special emphasis on the genera *Eriogonum* and *Penstemon.* Lastly, a host of recent newcomers to Rocky Mountain horticulture are featured as well as both western American natives and those harking from other regions with similar sunny, dry, cold-winter climates.

In designing this bed, I emphasized flowing, curved sweeps of plants whose colors, forms and textures play off one another through the months. The groupings needed to be large and bold, not "cottage" and soft, to stand up to the large structures and broad views that surround this garden, yet by staying away from formal shapes and lines, a less harsh feeling results. Most drought-tolerant plants work best in informal designs, for they tend to be softer-textured and looser in look, which can appear unkempt when pushed into a formal framework. I have strong reservations about the majority of so-called naturalistic water-conserving plantings. In a *non-naturalistic* setting, their sparse spacing, with no cohesion of groups or contrast of texture and color, results in a scruffy, undynamic, and weak design. One needs to be exceptionally conscious of contrasting shapes and textures as well as colors, or a shapeless blob emerges.

I combine plants in seasonal spots of color —as one grouping of several different blooming species wanes, another takes center stage. This way, during the growing season, there is always something in flower, always something combining and contrasting for interest. Winter holds much visual interest as well: evergreen foliage in varying muted tones forms a tapestry of texture and form until the first blossoms of hundreds of early bulbs once again start the color parade.

Color in this garden changes and progresses not only over time but also over space. As one walks along the planting, one moves through a "planted rainbow." Starting on the east end, one enters an explosion of bright reds, oranges, and yellows, cooled by blues and purples. Harmonious yellow and blue lead into the purples, magentas and pinks, softened by white and silver. Pale yellow returns with lavender, intensifies, and joins purple and finally blue at the far west end for a bold finale. So, whether one tends toward the bright, hot colors of the spectrum or prefers the cooler, more restrained pastels, there is a part of the garden to inspire.

The site is very hot, sloping south and surrounded by reflective and radiant concrete walls, walks and light fixtures. While all the plants selected are adapted to dry heat, intense sunlight, and little water, they still vary in their preferences regarding how much water and nutrient level and texture of the soil. The planting has been divided into three zones to accommodate these differing needs.

Lauren Springer, through her delightful northern Colorado flower garden, her book *The Undaunted Garden,* and many marvelous programs, is helping to make Rocky Mountain flower gardening the envy of other regions.

The first zone, at the lowest level, encompasses the plants between the walkway and the south side of the path winding through the garden. This zone has the richest soil, heavily amended with organic matter and fertilizer to simulate the perfect garden loam. This area also receives more irrigation than the others, but still considerably less than the typical Kentucky bluegrass lawn, annual bedding plants, or the traditional delphinium, shasta daisy, lupine require. The second, or middle zone, includes plants on the north side of this path approximately halfway to the evergreens at the back. The soil is leaner here, with adequate nutrient levels but little organic matter, and receives less water. The top zone, with the poorest soil and least irrigation, comprises the plants that reach up to and between the large evergreens.

Some plants may grow in more than one zone—these are adaptable enough to make their home in more variable conditions, making them highly tractable garden subjects. Some plants may not grow well in any of the zones, flunking out and then being removed—this garden is an experiment, a trial of drought-tolerant plants in a challenging site. As in all but the simplest gardens, there will be change over the years, as young plants replace the older ones losing their vigor, as promising new introductions replace the more staid plants. But, throughout the many changes, the Water-Smart Garden is intended to show that gardening with less water can be as full, rich, colorful and flower-filled as the most over-irrigated cottage garden, border, or annual bedding display, attractive to butterfly, bee, hummingbird and human alike.

This page: ***The Water-Smart Garden*** **at Denver Botanic Gardens.**

Left: *The Xeriscape Demonstration Garden* at Denver Botanic Gardens.

Below: *Calceolaria biflora* from Chile and Argentina is one of the many plants introduced by *The Rock Alpine Garden.*

Water-Smart Gardening™ at Denver Botanic Gardens:

The Rock Alpine Garden

Panayoti Kelaidis

The Rock Alpine Garden at Denver Botanic Gardens unofficially celebrated its fifteenth year of existence this past summer (it was practically all constructed in the summer of 1979, although plantings were only begun in earnest the summer of 1980). It's hard to believe that much of the grounds at DBG were fallow back then—not exactly fallow—quite a few had world-class clumps of Canada thistle, ragweed and veritable Guinness-Book-class clumps of bindweed. I remember how surprised I was that nothing was mulched. There were virtually no perennial plantings anywhere on the grounds at that time, excepting for thick clumps of daffodils along the conservatory wall (long gone) and of course the wonderful Herb Garden which was then, as now, one of our best and best-maintained gardens. Can you imagine Denver Botanic Gardens with no perennial borders, no xeriscape, no plains garden and hardly any water lilies? We have grown so quickly and so well that we never seem to take a breather to look back, and give ourselves a well-deserved pat on the back.

Not only were there few perennials at Denver Botanic Gardens, but most local nurseries had only the smallest selection of the commonest sorts. I described elsewhere, the exhilarating, delightful process we underwent to obtain seed, cuttings, plants from the leading local gardeners, then by mail order and finally, in desperation, by flying here and there. Planting an acre of fluffy soil, filled with weed seed, with tiny plants that don't even get very big is a daunting task, I can assure you. In retrospect I wish we'd experimented more with pre-emergents. I wish the scree and moraine mounds had been thickly mulched with stone chips from the start—these not only keep the roots of the high alpines cooler, they seem to slow the germination of weed seed substantially.

Mumbling and grumbling aside, I think it's appropriate at this point to sit down and make some preliminary assessments and observations about some of the artistic and botanical lessons the Rock Alpine Garden has taught us.

Diversity in Terrain

No style of garden epitomizes diversity so elegantly as a rock garden. First, there is diversity of habitat—berms and rocks provide a dizzying variety of niches so that gesneriads from the Pyrenees (*Ramonda myconi*) needing a shady, cool crevice can grow just a few feet away from a high mountain agave from New Mexico (*Agave neomexicana*). Rather than creating a uniform "chocolate cake soil," as in vegetable or perennial gardens, rock gardens can be designed to cater to desert plants, woodlanders, as well as alpines. Many habitats exist in the world's high places, and most are represented in the laboratory of biodiversity we call the Rock Alpine Garden.

By incorporating a rock garden in a home setting, imaginative gardeners are freed from the constraints and dullness of flat places.

Panayoti Kelaidis, curator of the Denver Botanic Gardens' Rock Alpine Garden, is sometimes known as "Mr. Ice Plant," for his introductions of numerous wonderful plants from South Africa and other semi-arid climates around the world. Panayoti is greatly appreciated for his infectious enthusiasm in pioneering our own new Rocky Mountain horticulture and design.

Berms and rocks can be used to mask unattractive features, add a focal point near a patio and just generally rise to a new level of drama and interest.

Year-round Garden

Many visitors to Colorado comment on how sterile and uninteresting so many of our landscapes are much of the calendar year. I suggest they come first to the Rock Alpine Garden any time of year, whether there's snow down there or not. Such a tremendous wealth of evergreen and silver ground covers, shrubs trees and perennials are available to grow in our climate that I have placed greater emphasis on the pleasing combination and textures of foliage in this garden than mere, fleeting bloom color. Even the longest-blooming annual usually lasts only a few months in our climate—a tiny fraction of the gardening year. But well over half the nearly 4,000 plants in the Rock Alpine garden have beautiful year-round effect.

Most alpines start to bloom much earlier in the year than do conventional perennials. On occasion we have kept phenological data on this garden: by May, when most Colorado gardens are yet to be planted, there are so many hundreds of kinds of alpines in bloom we invariably toss our notebooks up in despair. When I returned from Africa this past January, I was stunned to find several dozen kinds of plants—hellebores, heathers and snowdrops to be sure, but also cyclamen, eranthis, crocuses, drabas and a good many more—in full, glorious bloom in midwinter.

Western and Southwestern North American Center

Plants native to Colorado form an important core to the Rock Alpine Garden. We find we must plant Colorado columbines a number of places around the garden to satisfy that most common question, "Do you have your state flower?" *Agastache barberi, A. rupestris, Arctostaphylos patula,* most eriogonums aside from *E. umbellatum, Melampodium cinereum, Penstemon strictus 'Bandera', Penstemon digitalis 'Husker Red', Verbena canadensis, Zinnia grandiflora,* and many more nursery classics had their public garden debut in the Rock Alpine Garden—at least as far as the Rocky Mountain region is concerned. Once their utility is proved here, they are planted elsewhere on the grounds, and often feature at Denver Botanic Garden's annual plant sale a year or two before spreading into the local and national trade.

Eurasian Semi-arid Climates

Next to our native flora, the area that seems to have produced the greatest number of durable, showy garden plants is the vast belt of hot-summer, cold-winter climates that stretch from Spain and Morocco in the West all the way to China in the East. It is no secret that many Mediterranean plants possess great adaptability—since these form the core of herb garden floras. But countless ornamentals from higher and drier plateaux have largely been overlooked by gardeners, because they are absent from the cold, wet gardens of northwest Europe and the steamy eastern American states.

From Spain we introduced a deep orange foxglove with evergreen leaves (*Digitalis obscura*) and a variety of sea thrifts. Morocco has provided the long-blooming Atlas daisy (*Anacyclus pyrethrum var. depressus*), Greece an Turkey have produced an extraordinary variety of ornamentals in many of the same families as are in the Herb Garden, mints such as the giant yellow Jerusalem sage (*Phlomis russelliana*), thymes and germanders. Much of the summer garden is enhanced with showy bellflowers, from the Mediterranean, but the genus that has stepped to the forefront from this region is *Veronica.* Many local gardeners are growing *Veronica liwanensis* and *V. pectinata*—two of the showiest and most versatile new ground covers. Both had their regional debut in the Rock Alpine Garden.

Botanists have divided the Earth's floristic regions into a few dozen sections based on the uniformity and close relationship of plants that grow there. The largest such division is called the Irano-Turanian province—the vast steppes of Central Asia that stretch from Turkey to China. This stretch of nearly 4,000 miles of desert, grassy plain and a thousand mountain ranges is neatly dissected by the ancient Silk Route. Remote, romantic cities such as Ferghana and Samarkand lie in its heart. Much of this region is subjected to great summer heat and drought, as well as searing cold in the winter—a close climatic parallel to the western United States. It's hardly surprising that it has become a treasure trove of beautiful ornamentals—many of which have the added bonus of resisting our native insect pests. The best know exports are bulbs—especially the bulbous irises and dozens of species of tulips such as "waterlilies" (*Tulipa kaufmannia*) and 'Red Emperor' (*T. fosteriana 'Red Emperor'*). A genus that was virtually unknown in horticulture prior to the Rock Alpine Garden's development was *Acantholimon* (prickly thrifts). There are over a hundred species of these, practically restricted to the Irano-Turanian region. We grow nearly twenty of these in this garden—every one of which has outstanding ornamental merit.

Southern Hemisphere Steppe Plants

Perhaps the greatest excitement the Rock Alpine Garden has caused is the awareness of the genetic resources available to our gardens from the Southern Hemisphere. In 1980, the only plants from this region grown in local gardens were hybrid kniphofias. Today we are experimenting with hundreds of species of South African succulents, shrubs, bulbs, and a whole spate of long-blooming, stunningly beautiful herbaceous perennials. What would our gardens look like without the hardy yellow and purple ice plants? Diascias first made their appearance in the Rock Alpine Garden in 1982. But early in this garden's history I would have never dreamed that two of our greatest introductions would turn out to be long-lived, perennial *Gazania krebsiana* and a "freeway daisy" *Osteospermum jucundum.*

We have barely touched the high dry hills of Patagonia in South America, but the "astroturf plant," *Bolax glebaria*, is already a mainstay of local gardens. A number of calceolarias and calandrinias are appearing locally. There are sure to be many more plants from this region.

And finally, even New Zealand has contributed to local gardens. The Canterbury Plains in the South Island are both winter-cold and summer-hot. They have contributed three vigorous ornamental groundcovers to Colorado Gardens, *Roulia australis*—a silver scab plant, *Cotula potentillina*—a ground-covering daisy relative, and several hebes, such as *Hebe X youngii*, with lustrous evergreen leaves and purple flowers.

The dramatic structure of a rock garden is such that plants can mingle informally on its slopes, allowing for a greater freedom of expression and experimentation. There is no doubt that many more stunning, durable, and unique plants will find their way to our gardens from the slopes and berms of the Rock Alpine Garden.

Left: *The Nature Center Garden* at Chatfield Arboretum—a water-conserving garden designed to attract hummingbirds and butterflies while discouraging deer browsing.

Left: *The Visitor Center Garden* at Chatfield Arboretum—a Colorado native plant garden.

Bottom: *The Laura Smith Porter Plains Garden at* Denver Botanic Gardens illustrating shortgrass prairie.

Water-Smart Gardening™ at Denver Botanic Gardens:

The Xeriscape Demonstration Garden

A Display of Native Habitat Communities

Gayle Weinstein

Somewhere between the traditional and natural landscape lies the Xeriscape Demonstration Garden at Denver Botanic Gardens (DBG). I first conceived the idea for this garden after attending a dedication of a Xeriscape Garden at the Denver Water Department. What a great and timely idea—perhaps we (DBG) could develop a display of this type in conjunction with the Water Department. After approaching and receiving a "go ahead" with the idea from Merle Moore, Executive Director at that time, I soon made contact with Ken Ball, Conservation Officer for the Denver Water Department. He was equally enthusiastic.

Ken and I felt this garden should demonstrate water conservation in the landscape. However, we also wanted to represent a portion our western heritage with a design based on natural plant communities and associations. This garden would illustrate practical issues of gardening in dry lands as well as abstract the essence of arid and semi-arid ecosystems.

Once this philosophy was developed, I began to lay out design possibilities by researching photographs of semi-arid and arid regions such as the eastern prairies of Colorado, Nebraska, and Wyoming, the Colorado Plateau in Colorado, Utah and Arizona, and the Sonora, Great Basin and Mojave deserts. I also read through garden and nature periodicals as well as examined a variety of books on arid ecosystems. Selecting models of ecosystems of dryland communities and geographic areas was difficult because there were so many from which to choose. After considerable thought, southern Colorado was chosen as a model for the arid plains. Many plants for this area in the Xeriscape Demonstration Garden were collected off Interstate-25, such as James's frakenia (*Frankenia jamesii*), a compact dwarf shrub that to my knowledge had not been in cultivation. We went to the site several times to collect viable seed and cuttings to no avail, forcing us to dig and transplant shrubs from the site. This was a difficult task because the soil was so dry and loose. However, a few plants managed to survive. We were very successful in our collections of many colorful herbaceous perennials from this area like Wright's verbena (*Verbena wrightii*) and Blackfoot daisy (*Melampodium leucanthum*).

The desert community on the west side was patterned after the area near Carlsbad , New Mexico. With help from the Colorado Cactus Society we were able to acquire a variety of hardy cacti that would, otherwise, have been difficult to find. Although plants such as littleleaf sumac (*Rhus microphylla*), Fremont's mahonia (*Mahonia fremontii*) and desert peach (*Prunus andersonii*) were experimental, they did remarkably well.

The idea for the open woodlands, or pygmy forest, was taken from Colorado National Monu-

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Gayle Weinstein designed many of the Denver Botanic Gardens plantings, including the cutting garden, the Xeriscape Demonstration Garden, and the gardens around the Waring House. She also reorganized the Scripture Garden and the Laura Smith Porter Plains Garden. Gayle is now director of education at Bernheim Arboretum and Research Forest in Kentucky, and teaches courses in plant identification and planting design for the landscape architecture program at the University of Colorado in Denver.

ment and other places in the Colorado Plateau. Even the path mimicked the sandstone dry stream. Utah juniper (*Juniperus osteosperma*) and piñon pine (*Pinus edulis*) commanded the woodland setting along with random plantings of penstemons, eriogonums, and evening primroses. Wildflowers such as Baker's paper flower (*Psilostrophe bakeri*) and blanket flower (*Gaillardia pinnatifolia*), found their own niches growing in places other than where we planted them.

The eastern side of the garden was planted with "soft" and "hard" chaparral. "Soft" chaparral consisted of artemisias along with roundleaf buffaloberry (*Shepherdia rotundifolia*). an experimental plant that did surprisingly well. "Hard" chaparral included *Arctostaphyllos patula, A. nevadensis* and various mountain mahogany (*Cercocarpus spp.*) as found on the Uncompahgre Plateau in western Colorado.

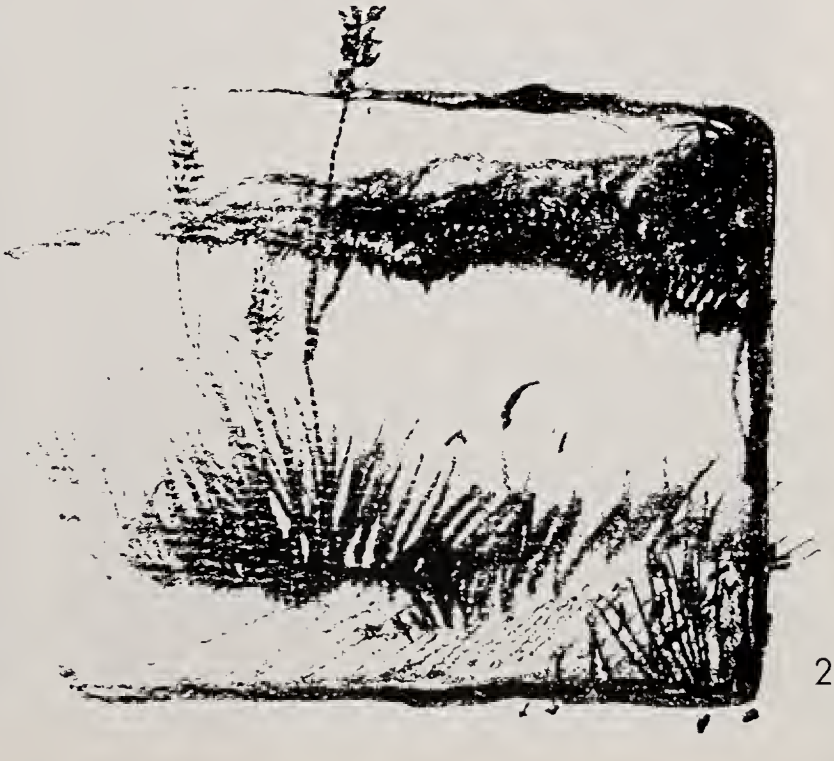
The savanna or parkland community, simulating Colorado foothills and intermountain valleys of California, was carpeted with blue grama (*Bouteloua gracilis*) and other grasses intermixed with various wildflowers such as epilobiums, rudbeckias, and penstemons. I tried some live oaks such as southern live oak (*Quercus virginiana*) and canyon live oak (*Q. chrysolepsis*), however, few survived.

Because the Laura Smith Porter Plains Garden, adjacent to the Xeriscape Demonstration Garden, included eight different grassland ecosystems, there was no need to represent the short or midgrass prairies in the Xeriscape Demonstration Garden.

After spending evenings drawing the plan to unify the selected plant communities, Merle Moore and Ken Ball critiqued it for improvements. Soon after, the design and budget were presented to our respective boards, and in a matter of weeks this new garden was funded by the Johnson Foundation and the Denver Water Department. Without delay, we began to create the garden. Ken and I went to rock quarries to select appropriate boulders for the framework. We methodically numbered boulders on the plan with those at the quarry, facilitating the rock placement once on site. In the meantime, Bill O'Hayre, a talented gardener at DBG shaped the earth, creating various topographic features including the mesa, hillside, and plains.

After the final selection of plants for each community, the garden contained over 350 species. Finding the plants was a real challenge. Since many native and dryland species were unavailable through commercial means, we had to seek them out ourselves. With the help of staff, volunteers, and plant societies, we collected seeds, propagules and plants from the wild, from plant experiment stations, mail-order nurseries and native plant organizations. The Xeriscape Demonstration Garden was beginning to house numerous botanical and cultural treasures. Not only did many of these plants emerge as potential material for landscape use, they also encouraged public awareness of species that grow with minimal water and care.

Some plants such as golden columbine (*Aquilegia chrysantha*), littleleaf sumac (*Rhus microphylla*), and squaw apple (*Peraphyllum ramosissimum*) established quickly and grew well. Others like huckleberry oak (*Quercus vacciniifolia)* and evergreen chinkapin (*Castanopsis sempervirens* now *Chrysolepis sempervirens*) were sluggish and barely grew. Some plants died within a short period of time, others mysteriously disappeared. Today, the Xeriscape Demonstration Garden is unique in depicting major types of dryland vegetation in natural plant communities. Although the areas illustrated in the garden are not exact reproductions, they give the appearance and texture of the dryland gardens more suitable to arid- and semiarid regions.



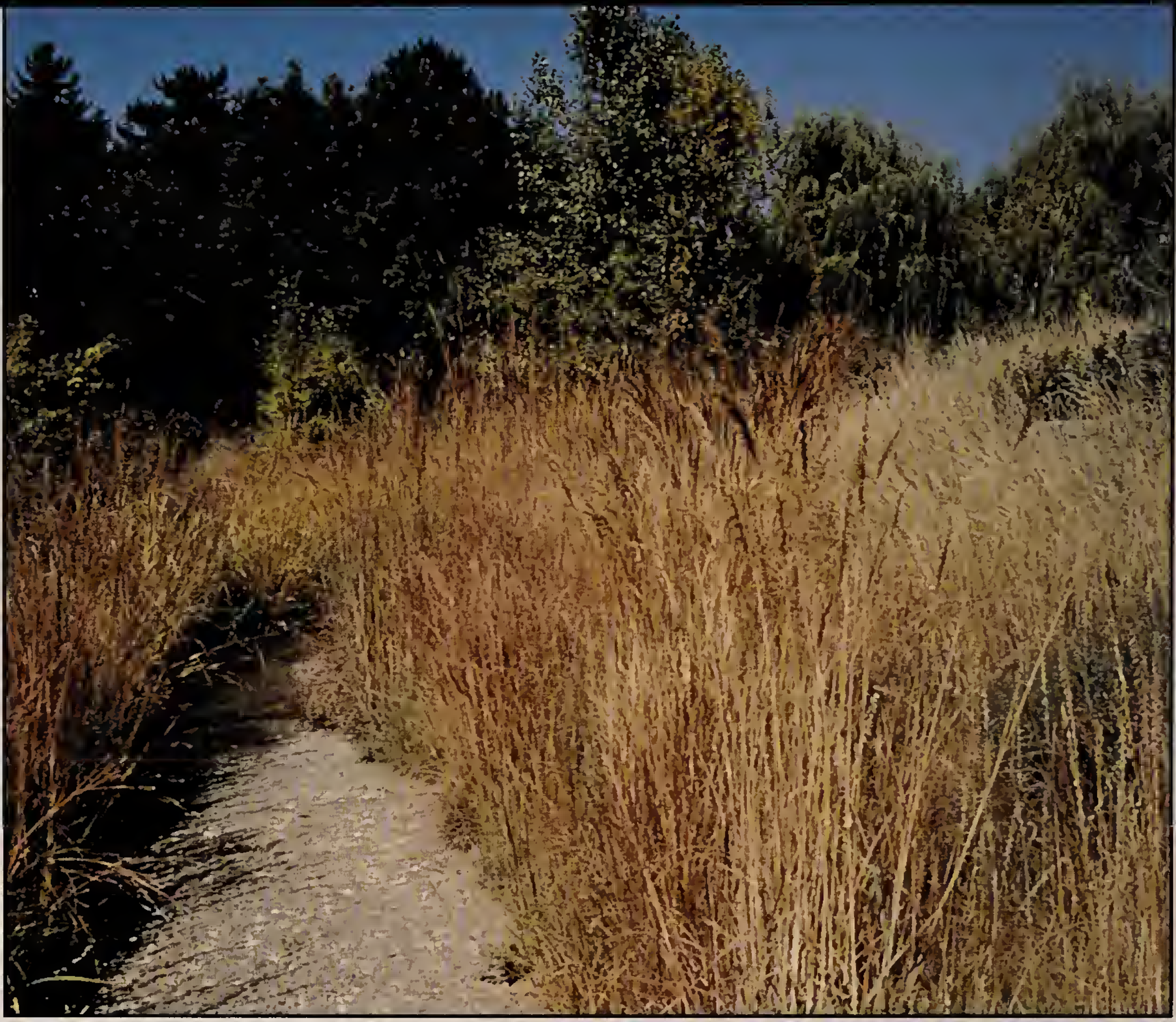
This page: *Tallgrass meadow* at Denver Botanic Gardens.

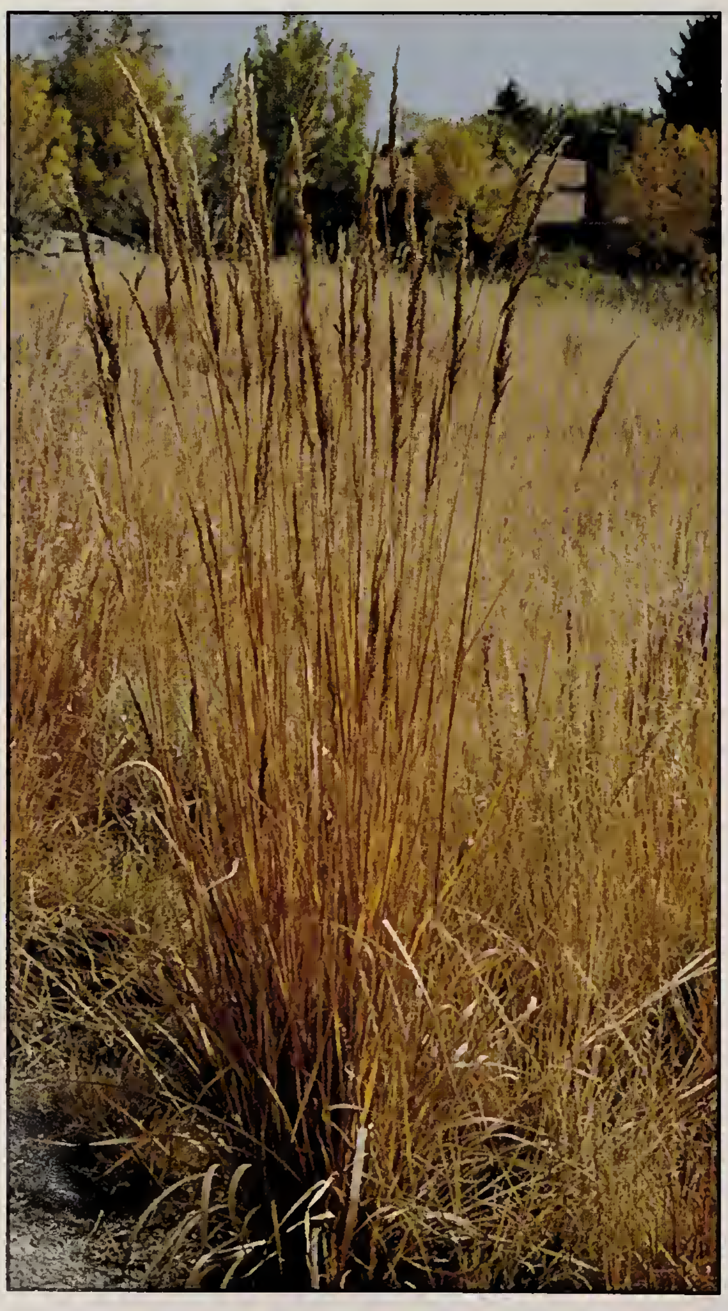
Below left: Indian grass (*Sorghastrum nutans*).

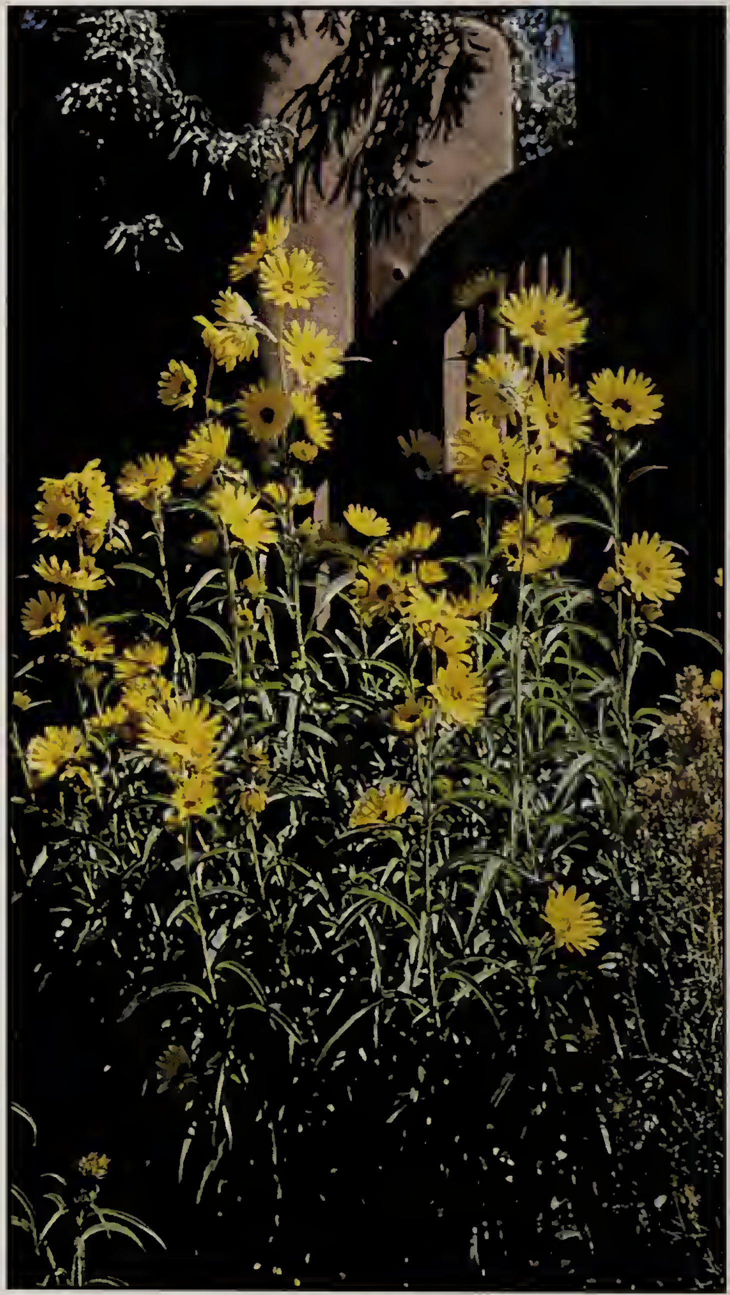
Below right: Maximilian's sunflower (*Helianthus maximiliani*).

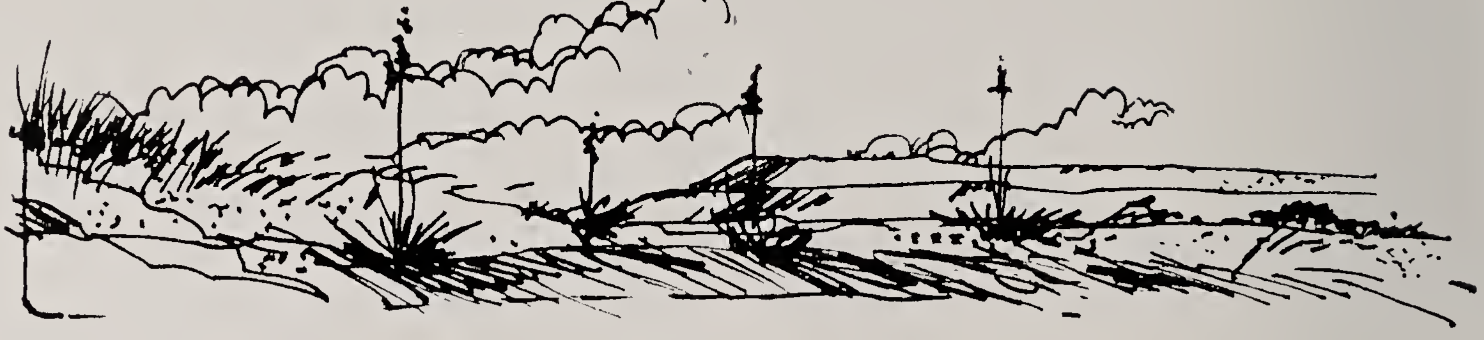
Opposite left: *Midgrass meadow*, blue sage, and blue flax.

Opposite right: *Shortgrass meadow*, chocolate flower, and poppy mallow.









The Nature Center Garden

A Waterwise Wildlife Garden

Jim Knopf

Speak of wildlife and gardening to a group of people, and half will immediately imagine beautiful butterflies, cute little hummingbirds and sunny "Chamber of Commerce "weather, while the other half visualizes rakish, raffish, rambunctious raccoons, and demonic deer in their roses or smelly skunks under a deck.

Though the combination of wildlife and gardening raises mixed emotions, it turns out that putting together waterwise (Xeriscape) gardening and wildlife gardening is a story of surprising serendipity. By zoning a landscape into dry, medium, and wet areas, for example, not only can lots of water be saved, but delightful diversity automatically results, and diversity is one of the key principles in successful wildlife gardening. Deer browsing, for example, drops off dramatically when a plant like creeping mahonia (*Mahonia repens*) is not irrigated. So, if you want to discourage deer damage but still be able to enjoy watching them, plant this or many other plants, in your dry zones. Diversity in plantings is also a primary principle for increasing the variety of wildlife in a small garden.

Waterwise wildlife gardening is a subject that is fascinating, frustrating, fun and even funny. It provokes thoughts about the role of native, near-native and introduced plants. It unveils our botanical bigotry—is biodiversity always good?—and how native is native enough? It involves the perplexing and promising world of pollination biology. Why, for example, do some flowers insist on attracting hummingbirds and repelling crawling critters, while other plants couldn't care less?

Waterwise gardening is a journey on which, "you'll win for awhile, but never forever." It's about being involved. It's about connecting with nature, right at home. It teaches that gardening is best when thought of as something to do rather than to be done with, and it can save *lots* of water.

With all of this in mind, two old farmhouses at Chatfield Arboretum have been landscaped to illustrate attractive, waterwise wildlife gardens, as they could be done in ordinary suburban situations. The traditional-looking lawns are turf-type tall fescue, requiring much less irrigation than Kentucky bluegrass. The garden area near the houses and along the front fence are dry zones, which get a little extra water by being near the lawn. The plantings in the parking lot are totally dry. The plantings have been selected to attract an array of wildlife, including birds and butterflies, while discouraging damage from deer and other cunning critters.

Xeriscape & Wildlife Gardening Principles

The Seven Water-Saving Xeriscape Principles

Illustrated at Chatfield Arboretum

1. **Plan & design** comprehensively from the start.
2. **Create practical turf areas** of manageable sizes, shapes and appropriate grasses.
3. **Use appropriate plants and zone the landscape** according to the water needs of the plants.
4. **Consider improving the soil** with organic matter like compost or manure.
5. **Consider mulches** like wood chips.
6. **Irrigate efficiently** with properly designed systems (including hose-end equipment) and by applying the right amount of water at the right time.
7. **Maintain the landscape appropriately** by mowing, pruning and fertilizing properly.

The Four Wildlife Gardening Principles

Illustrated at the Chatfield Arboretum Nature Center Garden

1. **Think locally when planning and designing your yard:**
   - A. Note the assets and limitations of your yard.
   - B. List species you *want* to attract.
   - C. List species you *do not want* to attract.
   - D. Note associations you want (predator/prey, pollination, etc.).
2. **Provide basic wildlife habitat needs consistently:**
   - A. Food.
   - B. Water.
   - C. Shelter.
   - D. Protection from environmental dangers.
   - E. Habitat diversity.
   - F. Effective habitat arrangement.
   - G. Consistent, year-round provisions.
3. **Be Prepared for wildlife mischief management:**
   - A. Be creative – Problems often become opportunities.
   - B. Be persistent – It never ends, you'll win for awhile, but never forever.
4. **Encourage curiosity and respect:**
   - A. Explore wildlife photography.
   - B. Explore wildlife drawing.
   - C. Develop and compare wildlife lists.
   - D. Try to visualize the garden as the critters see it.

Water-Smart Gardening™ at Denver Botanic Gardens:

The Visitor Center Garden
A Colorado Native Plant Garden

Marcia Tatroe

Chris Hartung, horticulturist at Chatfield Arboretum, called early in the summer of 1992 to ask if I might be interested in helping develop a Colorado native plant garden for the front of Chatfield's historic school house. I thought it sounded like a great idea—that is, until he casually added that the garden needed to be finished and flourishing in only six weeks, to be featured at an upcoming arboretum function. Given so little time, this didn't seem to me to be even remotely feasible. Still, he wanted to try. So, we scheduled a plant buying trip for the following week, and Chris started to prepare the site.

Surrounded by concrete on all sides, the garden is 12 feet by 120 feet, and slopes gently away from the schoolhouse towards the southwest. No trees or buildings shade this location at any time of day and so the soil here really bakes. The existing soil was the typical clay and gravel subsoil fill that most homeowners encounter when they start a new garden. However, Chris has a piece of equipment that the average homeowner does not. Since Chatfield is an operating farm, he has a tractor which he used to make light work of the drudgery usually associated with soil amending. He removed approximately half of the soil and replaced it with an equal amount of compost. Then, by hand and machine, he thoroughly dug the compost in to a depth of one to three feet. We were a little concerned that this mixture might be too rich for xeric plants, but on the other hand, drainage was now excellent.

Joined by a couple of intrepid volunteers, we met on a hot Saturday in July to assemble the garden. First, we positioned a dozen or so boulders somewhat randomly throughout the area to give the garden "bones." Then we placed the shrubs in groups along the spine of the hillside as well as tucking a few here and there among the rocks. Finally, we planted the flowers and grasses densely in drifts to fill in all of the remaining spaces. We gave some thought to texture, bloom color and bloom season when arranging the plants, but there was more plant tossing than careful placement.

Thankfully, my original fears turned out to be completely unfounded—the garden was in full bloom in a month's time. Natives of really extreme climates will often rush into growth in this way to take advantage of what might be only temporarily suitable conditions.

Most of these plants were initially very small, so for the first few weeks Chris watered often and heavily. Since then, he has watered only when he can find the time, more frequently in the spring, after adding new transplants to the garden, but generally no more than once a month in summer. Weeds and gophers continue to be his most persistent challenges. Weeds are hand-pulled but gophers aren't so easily dispatched. Chris says he often feels like the character in the movie "Caddyshack," who like himself, declares war on a gopher and loses—soundly!

Marcia Tatroe is a globetrotting gardener who has said that gardening in Colorado is much better than in England! She's also said, "If there is a plant on the moon, I'll want it." Her garden fills the entire front yard and most of her backyard, much to the amazement of her neighbors.

Plants in the *Xeriscape Demonstration Garden* at DBG can create attractive natural landscapes like this.

While some of the plants did not survive that first winter, the resulting gaps allowed Chris the opportunity to try some new things the following season.

Meanwhile, the shrubs have matured and became a more dominant feature in the planting. Fernbush (*Chamaebatiaria millefolium*), leadplant (*Amorpha canescens*), snakeweed (*Gutierrezia sarothrae*), rock spirea (*Holodiscus dumosus*), winterfat (*Ceratoides lanata*), and big western sage (*Artemisia tridentata*) all provide structure and year-round interest. Many of the penstemons, while performing very well for one or two seasons, were not long-lived. Perhaps the soil mix was too fertile for some of these after all. But, large clumps of stately red *Penstemon rostriflorus* (now *P. bridgesii*) are still thriving, and fiery-orange *P. pinifolius* set the bed ablaze in mid-summer. Tough, blue *P. strictus* and mat-forming *P. fruticosus* have persisted as well. The groundcover pussytoes (*Antennarea parvifolia*) has spread enthusiastically, as has the short-lived but freely self-sowing yellow daisy, *Thelesperma ambiguum.* Purple coneflower (*Echinacea purpuera*), Missouri evening primrose (*Oenothera missouriensis*), *Zinnia grandiflora,* goldenrod (*Solidago sparsiflora*) and chocolate flower (*Berlandiera lyrata*) all survive and prosper from the original planting. Grasses—big and little bluestem (*Andropogon gerardii* and *A. scoparius, syn. Schizachyrium scoparium*), Indian rice grass (*Oryzopsis hymenoides*) and blue grama (*Bouteloua gracilis*)—soften the brashness of the mostly red and yellow color palette and also lend an aspect of authenticity to the garden's overall prairie style.

This garden demonstrates just a hint of the potential that native shrubs and flower offer the Colorado gardener. It is as full, lush and satisfying as any pampered English border. But, more importantly, it better captures and reflects our own regional character and charm. Further, it does so with less work and water than would a similar garden composed of more traditional border flowers. For every maladapted import, there is a native alternative better suited to our unique climate and conditions. We simply need to get into the habit of making more rational plant choices. Like all successful gardens, the Chatfield Visitor Center Garden is continually changing and evolving—to really appreciate its beauty, you'll want to visit often.

Sample Plants Rated by Water Needs

Key to Water Requirements

High Watering Zones (H):
18 - 20 gals. added / sq. ft. / irrigation season
.5" added 3 times / week (when there is no rain)
30" +/- added / irrigation season
Typical turf: Kentucky bluegrass

Moderate Watering Zones (M):
10 +/- gals. added / sq. ft. / irrigation season
.75" added once / week (when there is no rain)
15" +/- added / irrigation season
Typical turf: Turf-type tall fescue

Low Watering Zones (L):
0-3 gals. added / sq. ft. / irrigation season
.5" added every other week
(only when very hot & dry)
4.5" +/- added / irrigation season
Typical turf: Buffalograss (as a lawn)

Notes:

Watering zone indications for plants in these lists are intended to show preferred conditions. Many of the plants will grow with either more or less water, under some circumstances.

The amounts of irrigation indicated for each watering zone are based on Denver Metro area average conditions (full sun, level ground, and soil with moderate clay content).

When (+/-) is shown with H, M, or L, it indicates that the plant is adapted both to somewhat more and less water. (?) indicates a best guess, but more observation in landscape cultivation is needed.

The Water-Smart Flower Garden

Ballota pseudodictamnus	L
Callirhoë involucrata, Poppy mallow	L
Digitalis lanata, Grecian foxglove	L M
Marrubium rotundifolium	L
Mirabilis multiflora, Wild four o'clock	L
Senecio longilobus, Threadleaf groundsel	L

The Rock Alpine Garden

Agastache rupestris	L M
Anacyclus pyrethrum var. *depressus* Atlas daisy	M +/-
Bolax glebaria	L M ?
Cotula potentillina, syn. *Leptinella potentillina*	L M ?
Gazania krebsiana	L M ?
Osteospermum jucundum	L M ?
Penstemon digitalis 'Husker Red'	M
Phlomis russeliana, Jerusalem sage	M +
Tulipa fosteriana	L M
Veronica liwanensis	L M

The Xeriscape Native Plant Garden

Mahonia fremontii, Fremont's mahonia	L
Peraphyllum ramosissimum, Squaw apple	M +/-
Prunus andersonii, Desert peach	L
Psilostrophe bakeri, Baker's paperflower	L
Rhus microphylla, Littleleaf sumac	L
Shepherdia rotundifolia, Roundleaf buffaloberry	L

The Chatfield Arboretum Nature Center Garden

Caryopteris x *clandonensis,* Bluemist spirea	L
Chamaebatiaria millefolium, Fernbush	L
Chrysothamnus spp., Rabbitbrush	L
Echinacea purpurea, Purple coneflower	M
Helianthus maximilianii Maximilian's sunflower	M
Salvia azurea, Blue, or pitcher sage	L M

The Chatfield Arboretum Visitor Center Garden

Andropogon gerardii, Big bluestem	M +/-
Schzachyrium scoparium, syn. *Andropogon scoparius,* Little bluestem	L
Berlandiera lyrata, Chocolate flower	L
Penstemon pinifolius, Pineleaf penstemon	L M
P. strictus, Rocky Mountain penstemon	M
Zinnia grandiflora, Prairie zinnia	L

Nifty Flowers for Nifty Rocky Mountain Landscapes:

The Perfect Perennial for the American West

Bob Pennington

Imagine, if you will, the "perfect perennial." More specifically, imagine the perfect perennial for the American West. Such a plant would have to meet quite an array of criteria—to be considered as a perfect plant such a perennial must be able to withstand not only searing summer heat and bitter winter cold, but also summer nights that might be near freezing as well. Such a plant ought to thrive at a wide range of elevations and be able to cope with both intense sunlight and more shaded areas. The perfect plant would not be particular as to its soil requirements and would be pest and disease-free. The perfect plant would also have a long blooming season, be easily propagated, and possess an attractive and unique flower. No, this is not "The Twilight Zone"—such plants do exist.

My nomination for the perfect perennial is a curiosity in many ways. Although it is the namesake genus of a family including many well-known genera, it is itself little known or grown. The Scrophulariaceae include such well-known horticultural standards as snapdragons, foxgloves, and of course, penstemons. But the *Scrophularia* or "figwort" is rarely seen in gardens, and certainly not appreciated.

Several different members of the genus *Scrophularia* have been suggested as the perfect perennial. My submission is for *Scrophularia desertorum*. *S. desertorum* naturally occurs along the east slopes of the Sierra Nevadas, in the Panamints and White Mountains of California, and in several mountain ranges in Nevada. Its altitude range is from 1,200 meters to 3,000 meters (4,000 feet to 9,800 feet), and it grows in dry sagebrush and piñon-juniper communities, often in crevices and among boulders.

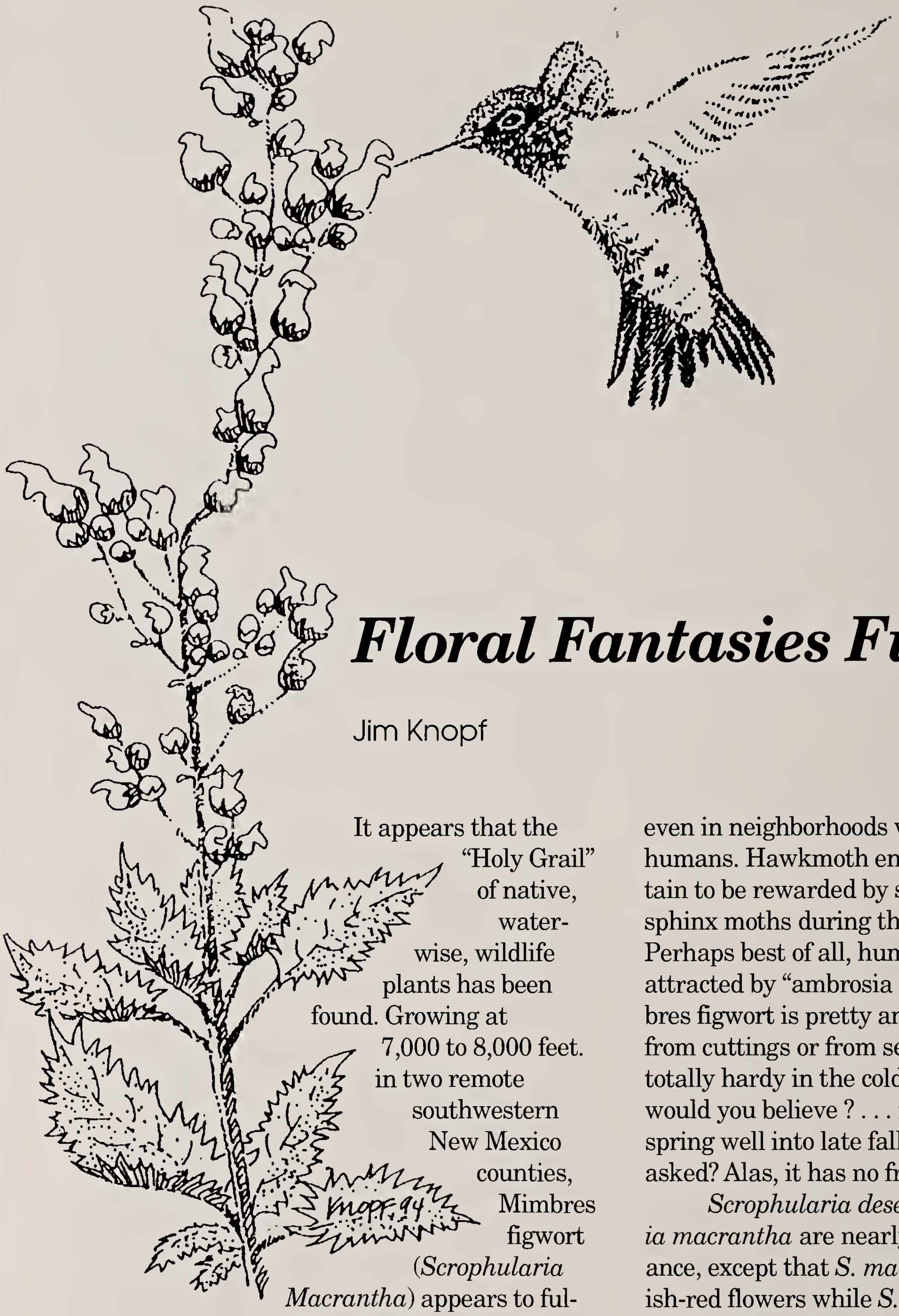
The seed I collected was from plants growing at the east foot of Sonora Pass in California. Seedlings from this collection have been grown in Santa Fe for three or four years, and we have experienced no difficulty either in propagation or in cultivation. At Agua Fria Nursery, the plants are watered heavily every night, while in my trial garden they survived one of the hottest and driest summers in our history, 1994, with no supplemental watering in July and August. The source plants of my seed were growing under the shade of ponderosas, while those in my graden are subjected to the unrelenting sun of our 7,000 foot elevation. I have yet to see either insect or disease pests affect my plants.

S. desertorum attains an average height of 3 feet, blooms from early July until killing frost, and has a unique flower both in form and color. The shape of the corolla is described as "globular, the throat not or only slightly constricted." To those familiar with the Saturday morning cartoon, "Ghost Busters," the flower bears a haunting resemblance to the ghost "Slimer." The color is wrong, as the ghost is lime green and *S. desertorum* is a velvety, dark cherry red. A few white forms were also grown this season so possibly other variations may exist as well.

Although to be scrofulous is to be morally bankrupt, growing *Scrophularia* will materially enrich the garden.

Bob Pennington, along with three generations of his family, runs Agua Fria Nursery in Santa Fe, New Mexico. This nursery is one of the mightiest of the many marvelous "micro-nurseries" and native plant centers of the great Southwest.

Nifty Flowers for Nifty Rocky Mountain Landscapes:



Floral Fantasies Fulfilled

Jim Knopf

It appears that the "Holy Grail" of native, water-wise, wildlife plants has been found. Growing at 7,000 to 8,000 feet. in two remote southwestern New Mexico counties, Mimbres figwort (*Scrophularia Macrantha*) appears to fulfill the long-standing floral fantasies of botanical "Holy Grail" hunters. Though extremely limited in nature, in gardens it thrives in sun, shade or in between. It also thrives in wet, dry or intermediate conditions. It does not appear to be finicky about soil type. Deer don't show any interest in munching it—even in neighborhoods where deer outnumber humans. Hawkmoth enthusiasts are almost certain to be rewarded by sights of scroph-seeking sphinx moths during the crepuscular hours. Perhaps best of all, hummingbirds are highly attracted by "ambrosia of scrophularia." Mimbres figwort is pretty and it is easy to propagate from cuttings or from seed. It appears to be totally hardy in the coldest Denver winters, and would you believe ? . . . it blooms from late spring well into late fall. What more could be asked? Alas, it has no fragrance.

Scrophularia desertorum and *Scrophularia macrantha* are nearly identical in appearance, except that *S. macrantha* has lovely pinkish-red flowers while *S. desertorum* has flowers ranging from all white to all red, but most being two-tone (the upper part being reddish and the lower part being whitish).

Drawing: *Scrophularia desertorum* is nearly identical to Mimbres figwort except for the color of the flowers.

Top & bottom left:
Mimbres figwort
(*Scrophularia macrantha*).
Hummingbirds love it,
deer don't.

Bottom: Purple banner variety
of sawsepal penstemon
(*Penstemon glaber*
'Purple banner').

Nifty Flowers for Nifty Rocky Mountain Landscapes:

Sawsepal Penstemon (*Penstemon glaber*)

Kelly D. Grummons

Intense blue flowers are such a treasure to most gardeners. In our brilliant Rocky Mountain sunlight, pale blues can't rival the tones brought out in our yellow, orange and red flowers. But if the blue is bright enough, the flower is considered a real gem.

Two years ago, while plant hunting in the Bighorn Mountains of north-central Wyoming, I was stunned with the vibrant beauty of sawsepal penstemon (*Penstemon glaber*) on roadsides. I recalled having seen the one-sided, large- flowered, royal blue beardtongue as a child on my grandmother's ranch between the towns of Dewey and Custer, South Dakota. With further investigation, I did find it growing sparsely at the ranch in the *clay* "redbeds." On a hunch, I followed the red clay vein about 15 miles northeast into Wyoming, a few miles east of Newcastle, into an area local ranchers call "the limestone." Here the populations of *Penstemon glaber* were more abundant, dominating steep roadcuts where very few other plant species grew. They seemed to be a favorite of summer-pasturing cattle. Fortunately for me, they were most often out of reach of my bovine competition.

P. glaber can be found in Montana, North Dakota, Wyoming, South Dakota and Nebraska. Claude Barr mentions it growing near Pueblo (Colorado?). The species is characterized by relatively large, glabrous (shiny), deep-green leaves, 2 to 4 inches long and .75 to 1.5 inches wide. The leaves are usually without a distinct petiole, simply wrapping around the flower stem. The flowers range from deep blue to purple blue with a lighter throat and are usually about one inch long. *P. glaber* is often confused with the shorter-lived but similar *P. alpinus* which rarely approaches *P. glaber* in color intensity.

Hortculturally, *P. glaber* has many desirable characteristics, primarily that it is blue and secondarily that it is long-lived, for a penstemon. Plants often form clumps up to one foot across in the garden. Bloom time and duration of bloom are valuable factors also—flowering generally occurs throughout June and July. Several flowers occur from each point along the flowering stem, one after the other, so that even later, as the upper flowers are opening, lower flowers are still emerging.

In *Jewels of the Plains*, author Claude Barr mentions the longevity of *P. glaber* and also that the flower color may be quite pale in years of more rain. I find that in the garden it should be grown with little or no water once flower spikes begin their ascent, otherwise the color is greatly washed out. Undoubtedly, this species' longevity, flowers, and great foliage will make it valuable to the penstemon breeder.

The ultimate blue form of *P. glaber*—pending further garden evaluation—may be 'Dayton blue', found near Dayton, Wyoming. An incredibly robust, "grape juice purple" flowered plant was found on the western side of the Big Horns and is named 'Purple Banner." This plant

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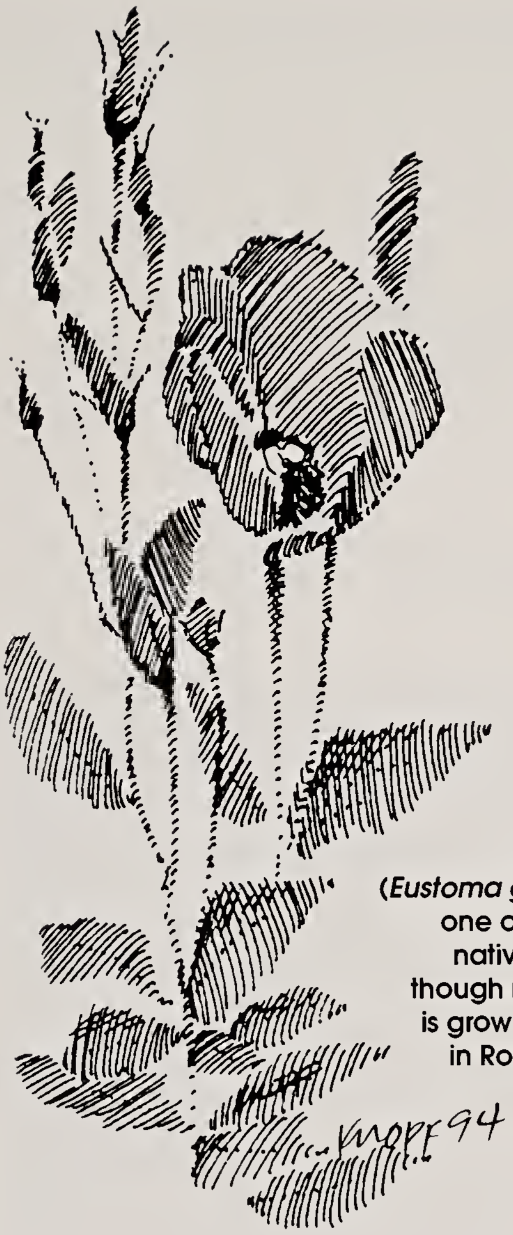
Kelly D. Grummons is head grower at Paulino Gardens in Denver. He received a B.S. in horticulture at Colorado State University, and was an intern at the Brooklyn Botanic Garden. He grew up in the Black Hills of Wyoming, and has a special passion for native prairie plants.

appears to be an interspecific hybrid. Whoever said, "We don't have enough color in the low-water garden!"? Imagine these sapphires and garnets among mounded pink marshmallowy drifts of *Oenothera speciosa* or the white and pink clouds of *Penstemon ambiguus*!

P. glaber is easily propagated at home by gently pulling offsets away from the mother plant in fall or early spring. These offsets will usually have a few roots and can be placed directly in the garden—give them a little extra water for a couple of weeks. Seed planted one-quarter inch deep in a bed prepared with a small amount of compost in October will germinate readily in April and May. They can then be transplanted in fall for a dazzling summer show. In the greenhouse, medium to soft cuttings root easily in peat and perlite with gentle bottom heat. Shade the cuttings lightly with cloth for a week or two until the leaves remain turgid. Avoid using a mist system and control fungus gnats because their feeding larvae are lethal to the callus tissue.

P. glaber is not readily available at local nurseries at this time but should be in a year or two. Seed may be available through the American Penstemon Society in their seed exchange (to members only).



Tulip gentian (*Eustoma grandiflorum*), one of our showiest native wildflowers, though rare in nature, is grown successfully in Rocky Mountain gardens.

Weeds We Like

Mikl Brawner

When my wife and I moved out of Boulder a couple miles into the open prairie with no trees to break the wind or for shade, we were shocked at how many plants died. In the midwest where we had grown up, plants, given reasonable care, lived. However, here my beloved trilliums turned to dust before my eyes and Linda's foxgloves never bloomed. Certainly we had lessons to learn about watering, soil-building and micro-climates, but it was obvious that one of our biggest problems was our choice of plants.

When I was in the Peace Corps in India, I often ran into predicaments with no apparent solutions; and I learned to follow the natives and imitate them even if it seemed foolish. In our new frontier world, Linda and I learned to imitate not only the successes of Panayoti Kelaidis, Jim Knopf and others, but also the successes of plants in the vacant ten-acre lot adjacent to us. What appeared at first to be a barren lot with short grass and some weeds turned out to be quite a resource. Now, ten years later, many of those "weeds" are hosted and admired in our xeric garden.

One of my favorites is *Tradescantia occidentalis*, the western spiderwort. I admit that part of my love for it probably comes from the resemblance of its bloom to the trillium's, but unlike the woodland trillium, whose three-petaled blooms are nestled low against low foliage, western spiderwort's unusual purple-blue three petals perch in clusters at ends of 16- to 24-inch stems. The narrow blue-green grass-like leaves arch obliquely from the stem, contrasting nicely in groups of shorter grasses like blue avena, or stand out as a poised warrior (spider) over a low ground cover. The May-June flowers only last a day but are produced prolifically for two to three months, or until the ground dries up. In the wild, it survives well in full sun, but its appearance may be improved in part shade. Unlike the more commonly available *Tradescantia X andersoniana* and *T. virginiana*, *T. occidentalis* is truly xeric, and although it reseeds, it does not spread aggressively by rhizomes in a xeric garden. It's true, the flowers do fold up in the noon-day sun, and after blooming, the plant may shrivel up or look coarse; but I can shear it, or I can overlook these undesirable traits as a true champion's noble defenses and can wait for its gold stamens against purple petals in the next season.

Another great favorite of the neighborhood (that is, the shortgrass prairie) is *Penstemon secundiflorus.* The long, spoon-shaped blue-gray leaves put up 10 to 16 inch leafed flower spikes of lavender-violet beardtongues blooming in May-June. This is a tough xerophytic plant, needing no watering once established. Single specimens are charming, but a spectacular mass can be achieved by crushing the dried seed pods over sandy ground. Don't expect the flowers to last all summer, but if you deadhead some of the seed pods, the foliage looks cleaner and the bluish color makes a great foil for lower flowers like *Phlox nana* (Santa Fe phlox) or *Callirhoë involucrata* (poppy mallow).

By the end of August when so many plants have finished their blooming and many other natives are dry and shriveled, *Liatris punctata* (dotted gayfeather) is just coming strong. By then its tufts of rough, very narrow leaves have sent up thin, stiff-leafed flower

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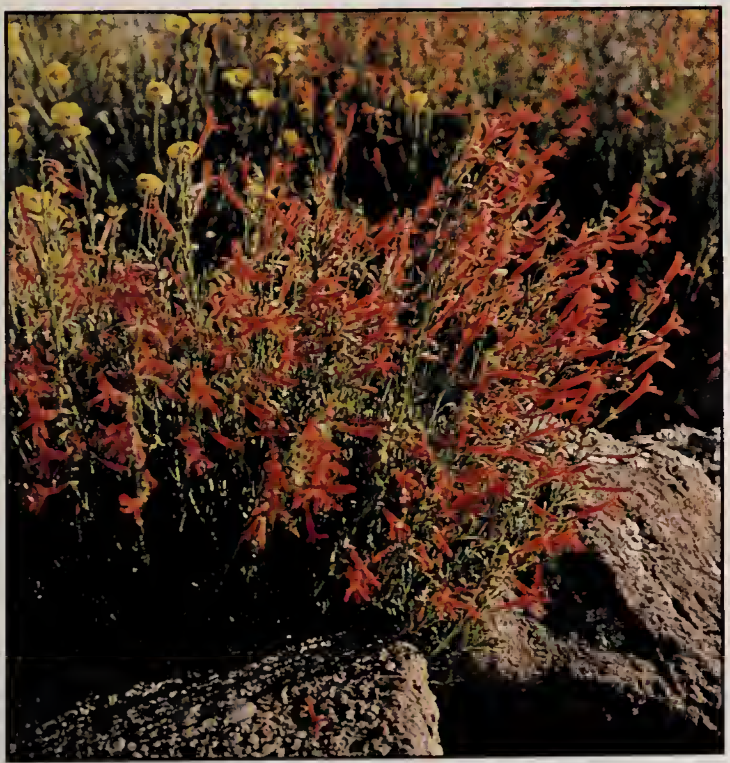
Mikl Brawner, when not up a tree doing "horticulturally correct" professional pruning, runs Harlequin's Market, an up-and-coming Boulder nursery specializing in xeric and native plants.

spikes 10 to 16 inches tall. These "feathers" of lovely lavender-purple flowers continue blooming for more than a month, sometimes till frost. They are stunning, especially in large clumps. Even in a dry year the energy stored up in its long, thick taproot gives a good fall display. Full sun and sandy-gravelly soil is its home, and no additional watering is required once established.

These are just some of the beautiful "weeds" that can be welcomed into a western garden. A few more of my favorites are: *Oenothera brachycarpa*, the evening primrose whose large yellow cups fade to burnt orange; *Verbascum blattaria*, the moth mullein having yellow flowers with violet centers fluttering up tall, thin spikes; the sand lily, (*Leucocrinum montanum*) whose six-petaled pure white flowers nestle against grassy foliage, and *Gaillardia aristata* whose bold Indian blanket red and yellow flowers enliven the dry summer.

In terms of a western garden aesthetic, there are many fine foreigners that fit in well here; but let's not overlook the wealth of natives which are both beautiful and (in the right spot) sustainable. They are becoming more available in nurseries, and if they are growing wild in your neighborhood, don't be too quick to pull an unidentified "weed."



Top left: Sidebells penstemon (*Penstemon secundiflorus*).

Bottom left: Pineleaf penstemon (*Penstemon pinifolius*).

Above: A collection of penstemons attractively used as a mass planting.

Nifty Flowers for Nifty Rocky Mountain Landscapes:

Penstemons to Star in Your Waterwise Garden

Ellen Wilde

I first became aware of penstemons when I moved to northern New Mexico almost twenty years ago and saw these lovely scarlet tubes, pendent from tall stems, everywhere, as I hiked the mesas and ponderosa pine woodlands in the summer and fall. I could not rest until I had identified them as *Penstemon barbatus*. As a gardener, I had to collect seed and try them; they grew easily in my garden. I learned about other penstemon species that grow in New Mexico, found them and also had success growing them from seed. A friend, to whom I raved about them, had heard of the American Penstemon Society and sent me a membership; Penstemania took hold! I learned from the Society that there are over 250 species in all colors and sizes and I have experimented with growing about 100 of them. Three-quarters of those have performed well in my unimproved clay-loam soil with light mulch and very little supplementary water. They endure temperatures as high as 100° F and as low as minus 40° F without snow cover. Strong winds, hail, and extended periods of drought don't faze them. Species native to my region even volunteer among the native grasses, in the gravel paths, and where sand accumulates in the little swales and checkdams that I build to stop runoff. What plant could be more desirable for waterwise gardening? They are beautiful in flower and also when not blooming—easy, never become a pest, and many attract butterflies and hummingbirds.

I hope you will use them in your garden and get started just as I did, by collecting seed from those that grow in your area. Loosen a patch of soil, top it with some coarse sand, sprinkle on some gravel to keep birds from stealing the seed and watch for the little seedlings to appear in April. Transplant if you get too many; they should not be crowed. A few species will bloom in their first year, but most will bloom the second year and for many years thereafter.

Most penstemon species of the Rocky Mountain region do not do well in the typical perennial border. Crowding, too rich soil and too much water are fatal. Instead, use them in different ways all around your property. Many such as *PP. palmeri, cardinalis, ambiguus, clutei,* and *barbatus* will make outstanding specimen plants beside a mailbox or at a corner of the house. A rock garden will make a perfect home for *PP. pinifolius,* (scarlet and yellow), *virens, teucrioides, laricifolius, crandalii, albertinus and linarioides.* In a grassy meadow, the tall erect spikes of *PP. virgatus and virgatus ssp. asa-grayi* look beautiful and don't make basal mats of leaves to crowd out the grass. *P. virens* is a small plant with wonderful short blue spikes that is at its best under pines where it gets sun only part of the day. *P. strictus*, called Rocky Mountain penstemon, has a basal mat of rich green foliage which looks good all year. The royal purple flower spikes rise from it in May and occasional ones appear through the summer. The mat enlarges rapidly; this one could be called a pest in some situations where increase is undesirable. But how can anything so beauti

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Ellen Wilde ran the American Penstemon Society seed exchange for five years. She is active in the New Mexico Native Plant Society, and is on the board of the new Santa Fe Botanical Garden. She loves learning about western native plants, and her long-standing passion for penstemons shows in her lovely garden.

ful be called a pest? It will take some shade and more water than most, if it has good drainage. The majority of penstemons bloom in May and June, but some such as *P. nitidus*, bloom earlier and some, such as *PP. barbatus* and *rostriflorus (formerly bridgesii)*, bloom later, extending the season well into the fall. Penstemons and penstemon seeds are available from many sources. Seeds ripen about six to seven weeks after the flowers are gone. They are in hard little tan capsules that often need to be broken to release the seeds. Sometimes the capsules release the seed easily and these need to be collected before they drop. The seed should be kept dry until planted.

The American Penstemon Society (c/o Ann Bartlett, 1569 South Holland Court, Lakewood, Co. 80232) has a seed exchange with penstemon seed from all over North America, in addition to being the best source of information on penstemons. The dues are only $10.00 per year. Commercial sources of seed are: Rocky Mountain Rare Plants (P.O. Box 200483, Denver, Co. 80220-0483, catalog $1.00); Plants of the Southwest (Rt. 6, Box 11A, Santa Fe, New Mexico 87501, catalog $3.50, price list free), Northplan/Mountain Seed (P.O. Box 910, Moscow, Id. 83843, catalog $1.00); Alplains (32315 Pinecrest Court, Kiowa Co. 80117, Catalog $1.00); Northwest Native Seed (915 Davis Pl S, Seattle. Wa. 98144, catalog $1.00). Catalogs contain much useful information also, so send for several.

Many nurseries offer penstemon plants; these should be considered if you can't wait to have some penstemons. Small plants in two-to-four inch pots generally will need quite a bit of coddling to be weaned from the potting mix in which they are grown, and the frequent watering they receive in the nursery; they cannot be considered drought tolerant their first year. Plants in gallon containers have been weaned and should establish well if the soil in the container is fairly similar to that in which you are planting them.

Be waterwise and enjoy these colorful western beauties! Before you know it, you too will become a "penstemaniac"!

Native Landscaping for Many Reasons

Alison Peck

People have many reasons for their interest in native-plant landscaping. Some of us are fascinated by native plants and want to surround our homes with them. We enjoy working with native plants, discussing them—their availability, how to propagate them, what is "native"?, and how to create an environment they will thrive in . . . all issues relating to the plants themselves. Many of us who are interested in native-plant landscaping are primarily plant people. We may even consider native plants with more interest and concern than we give our human neighbors. The continued existence of a healthy community of native plants is important for a wide variety of reasons.

Some of us pursue native-plant landscaping because we love the beauty of this place and wish to re-create some of that beauty in the landscapes we live in. There is also resource conservation: well-designed and well-created native plant landscapes consume little or no water, fertilizer or pesticides. And some of us wish to provide homes for birds and insects that we enjoy. While these are all goals often associated with the use of native plants in landscaping, only the first goal requires the use of native plants. As an experienced landscape designer, I am confident that I could design and install a landscape that looked "native" to many Front Range citizens, which conserved resources and which provided wildlife habitat, without using any native plants. But simply assembling a landscape of native plants does not yield a native landscape. By a native landscape, I mean a landscape that *appears*, *functions* and *evolves* as does a natural, indigenous landscape. I would even venture to say that all of the plants and animals inhabiting what is left of our native wildlands benefit much more from the creation of landscapes which *function* as native landscapes, and which minimize disturbance and destruction of natural areas, than from the picture-perfect assemblies of native plants which require artificial life support.

It is easy to overlook that a native landscape, a landscape native to this place, is more than an assembly of native plants. Those of us interested in native-plant landscaping share many questions and concerns with those people working in the new field of ecological restoration. Ecological restoration has as its goal the restoration of landscapes which have been damaged by human activity. There are many questions that arise: how do we know what to restore, and what is our measure of success? What point in the history of the landscape do we take as our goal? Are we striving to re-create a landscape which is pre-human? How did the indigenous people interact with and manage the landscape? If we decide on our goal, how do we re-create this particular landscape? Once the landscape is re-created, do we want it to always stay this way, or is it going to evolve into something different? These questions may be more far reaching, and have a wider scope, than the questions most of us consider when we wish to do native-plant landscaping, but I believe that

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Alison Peck, when not running Matrix Gardens (a Boulder, Colorado landscape design and construction business specializing in edible landscapes, water and energy-efficient designs and permaculture) spends time ruminating about who gets the best of her edible landscapes ... aphids, deer, raccoons or maybe humans.

any of us who are interested in creating healthy, self-sustaining native plant landscapes will eventually approach these questions.

The inevitable conclusion that ecological restorers have come to is that ecological restoration requires the re-establishment of native plant and animal communities within the same context which shaped the original landscape. This context includes the soils, the hydrological cycles, the energy and nutrient cycles; all of the conditions and forces which contained the predisturbance landscape. Without this, what is created will not function and evolve as the original landscape did. Clearly, a complete restoration is not possible in most situations because we have lost too many of the pieces. A restored riparian ecosystem must experience the periodic flooding and hydrological cycles which created it, or it will evolve into something else which may no longer provide habitat to native plants and animals. A prairie must be subject to grazing and fires. The more pieces which can be included, the closer the restoration will be to the original. These same questions and understandings can be applied to our discussion of native plant landscaping. We can look beyond appearance to consider the conditions within which we create a native landscape and how the landscape functions.

How can we create landscapes which resemble and function as native landscape? The few simple ideas I have come across fall into two general areas: looking at the conditions within which the new landscape will be created, and studying the existing and possible functions of the landscape. These can be done by studying the site within which you wish to help create a new landscape; learning as much as possible about the plants, animals, soils, climate and people involved in the landscape and asking what effect this new landscape will have on the world. In studying the site, one can look at the climate, water, energy and nutrient cycles, existing plants and animals and anything else which will effect how the new landscape is created, how it is established and how it evolves. Some of the questions to ask might be:

How does water circulate? Where does it come into the landscape? Is it clean? What are the pollutants? How will the landscape get the water it needs? Will water need to be imported? Where will it come from and how will using it affect surrounding areas?

Sand lily (*Leucocrinum montanum*). An easily-grown native unfortunately little known in the nursery trade.

How does air move across the land? What does it bring with it (weed seeds, sand, trash)? Is it a drying wind? A cold or warm wind?

What is the existing soil? How is it different from the native undisturbed soil in which the original native landscape grew? What can be done to help re-create the soil in which native plants thrive?

What plants are already growing on the land? Will they be compatible with the plants I wish to introduce: If not, how do I get rid of them? How will my method of weed control affect what grows in the future? How will it affect surrounding life?

As we learn about the site and get a sense of its cycles and patterns, we can begin to see where particular plants and plant communities may find a home. As we learn about where the materials we use in landscaping come from, and what the products of the landscape are, we can find ways of landscaping that are minimally destructive to the natural areas that do remain. And perhaps we can help create landscapes which enhance the beauty and vitality of the natural world; landscapes which are native in the sense that they inhabit and participate in the local web of life. The fragmented patches of native plant landscapes which we re-create in our backyards will never provide habitat for large native mammals, but perhaps they can still be important in preserving the life which supports us all.

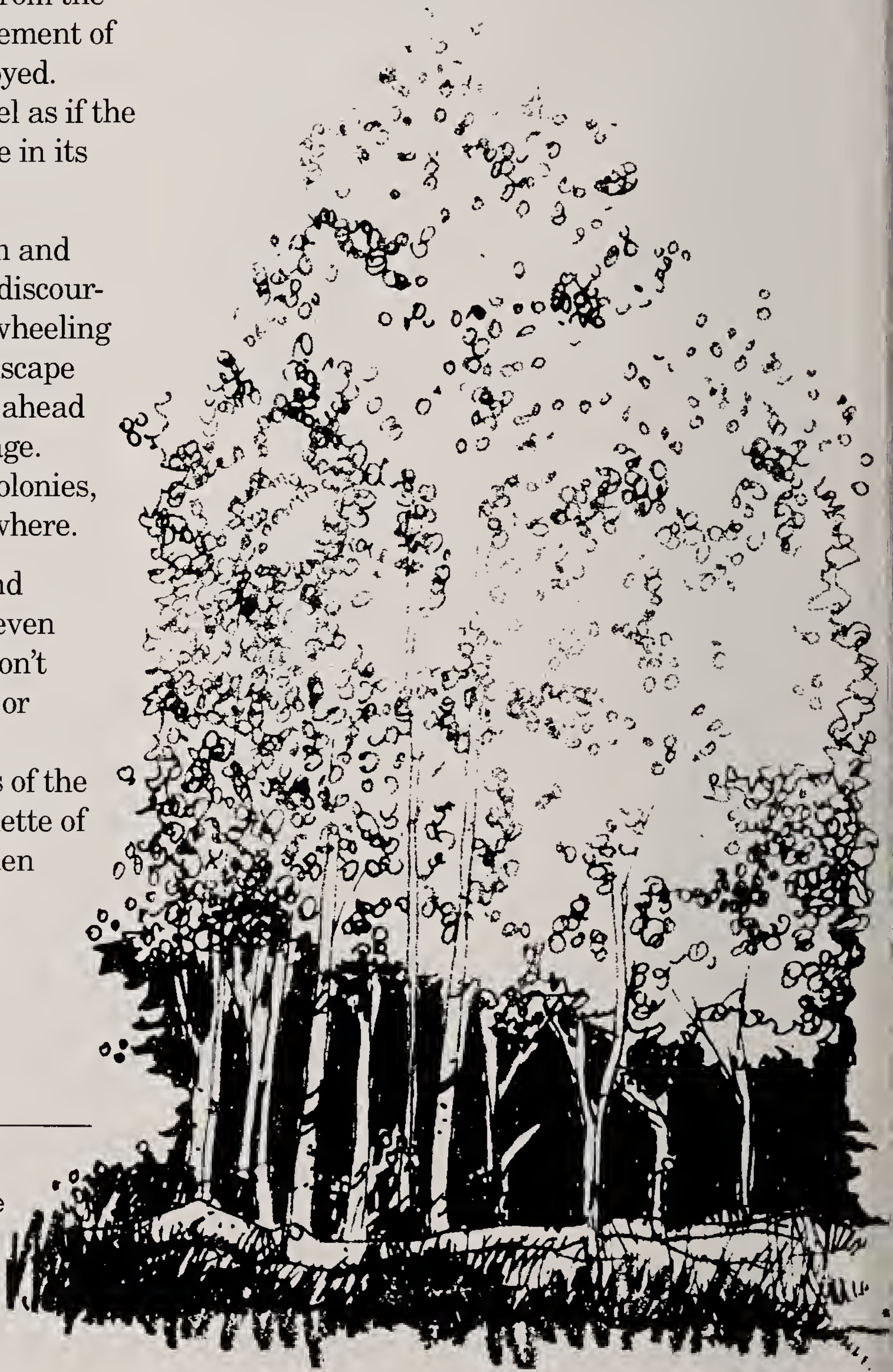
Going "All the Way"

Nancy Daniel

When going "all they way," a landscape that features native plants has one simple principle—your home should look and feel as if it grew out of its natural environment. From the outside it would seem as if no single element of the original landscape had been destroyed. Looking out the windows one would feel as if the house had been there forever—at home in its native surroundings.

Nature may appear to be random and chaotic to some, but this should never discourage you from accommodating her freewheeling adventures in your yard. A native landscape will inevitably change with time. Plan ahead so these changes work to your advantage. Plant seeds of flowers and grasses in colonies, rather than prepackaged mixes everywhere.

Plant, too, for the optimal size and growing habits of your plants, so that even when the plants grow together, they won't impair your home's walls, foundations or plumbing. Then allow nature to take over. The natural materials and plants of the Rocky Mountain region offer a rich palette of colors, shapes, forms and textures. When used to design your environment *and* answer your needs for open and closed spaces, a native landscape will be an ever-changing yet everlasting source of pleasure.



Nancy Daniel, landscape architect, runs Native Landscapes, a landscape design and construction business, from a wonderful natural setting in the piñon-juniper landscape of Santa Fe, New Mexico.

Authentic Aesthetics—Landscaping with Rocky Mountain Natives:

For More Livable Urban Surroundings

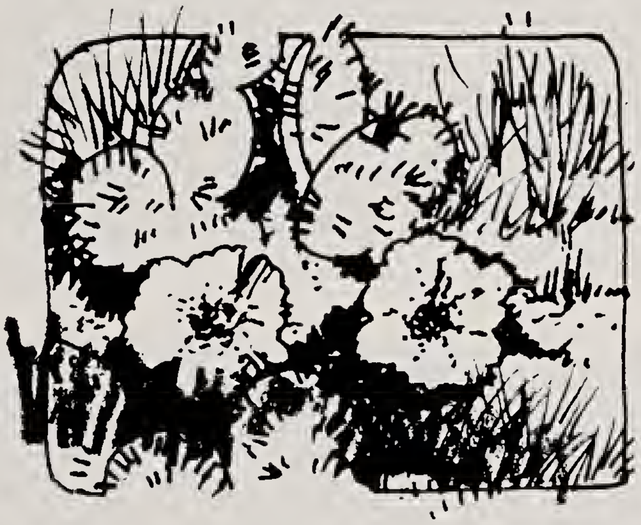
Susan Eubank

If we planted blue grama and buffalograss in some urban areas and let the natural rainfall determine their greenness, perhaps some of the artificiality of the urban environment would also disappear.

My personal choice for natives is based primarily on aesthetics. As a country girl, forced to live in a city, the natives in my garden bring me closer to that rural environment I miss. I do have non-natives in my garden—that too is based primarily on aesthetics.

There has been a recent flurry of discussion in the popular horticulture press about the use of natives as garden plants. It is heartening to see recommendations for plants other than the traditional English perennial border plants, but the controversy surrounding the subject is distressing to this particular plant lover. I quickly made my own comparison to xenophobia when I read about how adamantly some people advocated using only natives in home landscaping—Let's not bring that fear into the current debate about garden plants.

Some introduced plants are a problem for the stability (purity) of the plant ecosystems which they have invaded, but aliens like tamarisk, Russian olive, and purple loosestrife threaten whole habitats including the animal populations which depend on the natives for food. Another reason to plant natives in our yards is so the local animal populations (including bears and cougars?) will continue to have some semblance of the habitat that existed prior to contact with Europeans.



Susan Eubank, former associate librarian at Denver Botanic Gardens, is now the librarian at the American Alpine Club in Golden, Colorado. Susan is also editor of *Saximontana*, the newsletter of the Rocky Mountain Chapter of the North American Rock Garden Society.

Below: An attractive water-conserving mixture of native and introduced plants.

Right: Native, low-maintenance tallgrass meadow at Denver Botanic Gardens.

Bottom: A reconstructed Piñon-Juniper landscape creating an attractive, low-maintenance setting for these adobe buildings in Santa Fe.

Opposite page: Purple coneflower (*Echinacea purpurea*). Native of tallgrass meadows.

Authentic Aesthetics—Landscaping with Rocky Mountain Natives:

When Is a Native "Native?"

John Lawyer

When considering the use of introduced plants, consider the following questions:

1. Is the species potentially invasive, whereby it becomes a weed?
2. Will the species disrupt, or will it maintain the desired natural look?
3. Will the species be a host or carrier of pests and diseases, and will it be resistant to those which occur naturally?
4. Will it survive and serve the intended purpose?

In response to the perennial question, "What is a native plant?," a better question might be, "WHEN is a native native?" To illustrate the problem, consider the case of dawn redwood (*Metasequoia glyptostroboides*), which fossil records indicate was widespread in North America and Asia from 23.7 to 1.6 million years ago. Before the 1940's it was thought to be extinct. However, when a small grove was discovered alive and well in China the question became . . ."should dawn redwood again be considered a Rocky Mountain native plant?"

The ginkgo tree (*Ginkgo biloba*) is another example. Fossil records indicate that this tree grew in western North America, Asia and Europe from 208 to 144 million years ago. Ginkgo State Park in eastern Washington was established to protect fossils of ginkgo trees. Long considered extinct, it is now considered to have survived under natural conditions in Chekiang province in China. It was returned to the United States in 1784, and could again be considered a Rocky Mountain native species.

"What is a native plant?" "How native is native enough?" "When is a native plant really a native plant?" Inevitably these questions will be answered differently by different people, at different times. Fortunately, there is room for a variety of answers, and lively but tolerant discussion is to be encouraged, keeping in mind that, "always" and "never" should "seldom" be taken too seriously, and all rules "probably" have exceptions.

John Lawyer is president of Lawyer Nursery (Plains, Montana, and Olympia, Washington) a wholesale company providing a large selection of seedlings, transplants and cutting-grown nursery liners of native and naturalized trees and shrubs to the wholesale nursery trade.

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Front cover photo: *The Water-Smart Garden* at Denver Botanic Gardens designed by Lauren Springer.

Back cover photo: The Colorado Springs *Xeriscape Demonstration Garden* has rock walls and paving that reflect the nearby redrock formations, and many hardy, attractive flowers.

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